SCIENTIFIC AMERICAN

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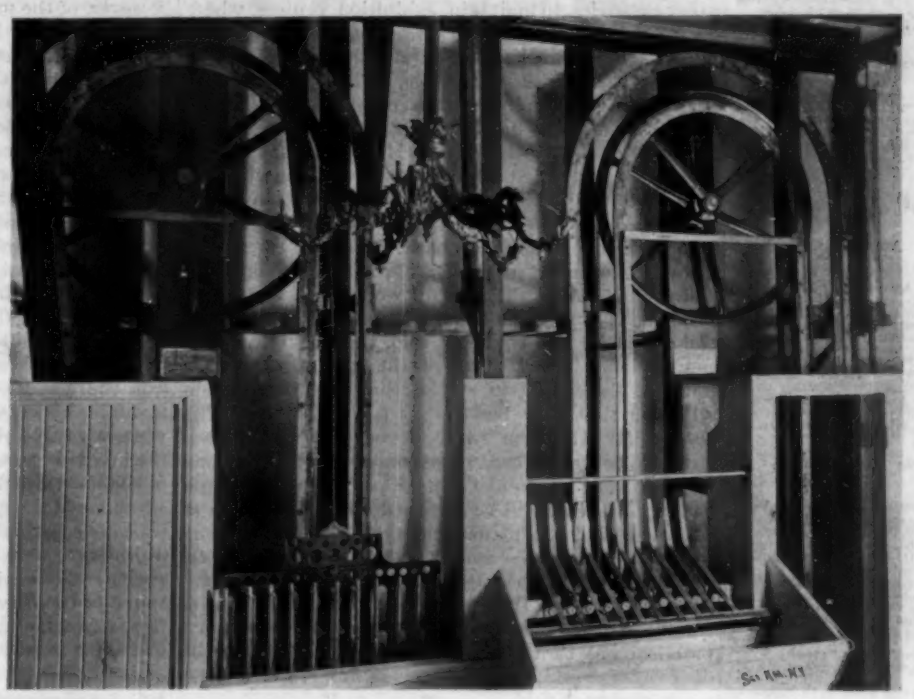
THE BOOK CARRIERS OF THE NEW LIBRARY OF CONGRESS BUILDING.

BY E. J. PRINDLE.

The new building for the Library of Congress is, probably, in its architecture and decoration, the most perfect public building in this hemisphere. A great deal of machinery is necessary to conduct the affairs of so large a building, and the mechanical and sanitary features have been the objects of most careful and skillful attention. The lighting, heating, and ventilating systems represent the highest development in those directions; and, in designing them, as with all the other engineering work in the building, the object of the building has been kept constantly in view.

The Library of Congress contains seven hundred thousand volumes, exclusive of duplicates and pamphlets to the number of three hundred thousand. It is no small problem to provide machinery which will bring any one of this great number of books from the necessarily large and distant book stacks quickly to the reading room of this building or to the Capitol for the use of Congress.

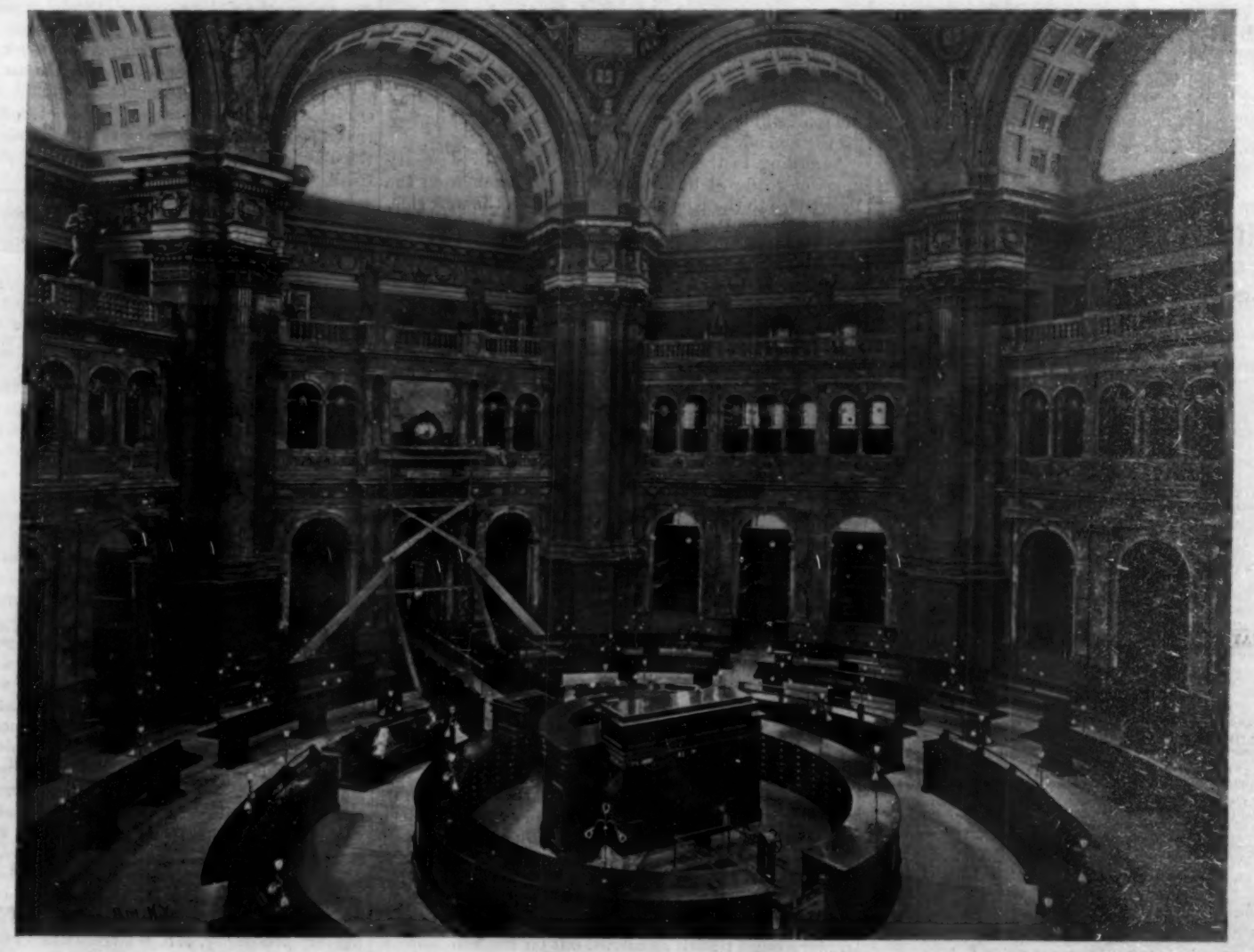


CAPITOL TERMINAL OF THE LIBRARY-CAPITOL CARRIER.

For the latter purpose a book carrier runs from a terminal beneath the rotunda or reading room of the library building through a tunnel twelve hundred feet in length to the Capitol, where a second terminal is located between the Hall of Statuary and the library of the United States Supreme Court. The tunnel is well lighted by electricity and is large enough for easy passage erect. This book carrier was installed by Mr. George Miles, of Boston, Mass. A double track runs from one terminal to the other, and an endless half-inch cable draws two baskets or carriers constantly around the track. The carrier consists of a solid back and sides and a bottom and front formed of a series of parallel, U-shape fingers secured to the back and having no obstruction between the fingers. Strips of felt are secured in grooves in the fingers to protect the books. The carrier is pivoted to the face of a two wheel truck that is secured to the cable, the wheels of the truck being in the same vertical plane.

The track consists essentially of two flat rails, one above the other, between which run the carrier wheels, and a rail beside the upper of these rails, against which anti-friction rollers bear that are journaled on the back plate of the carrier. The truck follows the inclination of the track, but the carrier remains vertical. As all machinery in the library is required to be as nearly noiseless as possible, the track is supported by rods from rubber washers in the ceiling. At the terminals, the track passes up and down twice in the general form of the letter M, except that curves replace the angles. A guide wheel in each curve of the terminal keeps the cable in proper relation to the track. The carrier traverses a terminal from right to left, and it deposits its load on the first descent and takes the books for the return trip on the following ascent. A series of stationary fingers is secured in front of a trough at the unloading point, and the fingers are inclined upward and back. As the carrier descends, the stationary fingers of the receiving station project between those of the carrier, and the books are left by the carrier to slide into the trough. As the carrier ascends the next vertical section of the track, it passes through a series of U-shape, stationary fingers similar to those on the carrier; and any package that may have been deposited in these stationary fingers is caught up by the carrier and taken

(Continued on page 120.)



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Contents.

(Illustrated articles are marked with an asterisk.)

Air brake instruction car*..... 117
Air, liquid, possibilities of..... 118
Black art*..... 123
Book carriers, National Library* 123
Books, new..... 124
Cannon, casting a big..... 119
Cyclists, military, dogs to attack 122
Electrical work, liquid air in..... 118
Electric celebration, Maine..... 118
Electricity, contact, Lord Kelvin on..... 126
Electric power, Richmond, Va.. 118
Exposition, Pan-American, 1898. 119
Fear and thunder and lightning 122
Ferry steamer, a seagoing*..... 121
Hammer, Treat's nail-holding*.. 120
Inventions recently patented..... 126
Library, National, the*..... 113
Locomotive counterbalance problem, the..... 125
Looks of people..... 119
Magic*..... 120
Mail transfers, railway*..... 116
Mechanism, book carrier*..... 120
Nail holding hammer, Treat's*.. 123
New York City, rapid transit in.. 114
Notes and queries..... 126
Patent attorneys, registration of 115
Patent attorneys, deceptive methods of..... 114
Patent Office employes cannot take out patents..... 119
Patents granted, weekly record of..... 125
Pension roll, big..... 124
Pere Marquette, the*..... 121
Prosperity..... 114
Railway air brakes*..... 117
Railway mail catcher and deliverer*..... 116
Rockies, climbing the..... 116
Rotunda of National Library*... 113
Sand storms at Cape Ann..... 118
Science, modern, advances of... 119
Science notes..... 122
Skeleton, disarticulated*..... 123
Space, earth traveling through 124
Stage illusions*..... 123
Steamer, stern wheel, ocean voyage of..... 115
Thunder, lightning and fear..... 122
Town and cape, saving..... 118
Trade, South American..... 114
Tunnel, rapid transit, New York 114
Universe, extent of the..... 124
University of California, the.... 119

TABLE OF CONTENTS OF

Scientific American Supplement

No. 1129.

For the Week Ending August 21, 1897.

Price 10 cents. For sale by all newsdealers.

PAGE

I. AERONAUTICS.—The Captive Balloon in the Navy.—1 illustration..... 18039

II. AGRICULTURE.—American Horses for Germany..... 18044
Electric Plowing.—2 illustrations..... 18047

III. ARCHÆOLOGY.—Cannibalism in Ancient Egypt.—15 illustrations..... 18040

IV. BOTANY AND HORTICULTURE.—The Coryanthes.—2 illustrations..... 18043

V. CIVIL ENGINEERING.—The Dortmund-Ems Canal.—A description of the canal and ship elevator.—1 illustration..... 18046

VI. COMMERCE.—Possible Steamship Service between New York and Tangier..... 18039

VII. ECONOMICS.—Nutritive Value of Food..... 18038
Germany's Industrial Growth..... 18049

VIII. ELECTRICITY.—Electric Plowing.—2 illustrations..... 18047
Advice to Builders of Electric Railways.—By G. WHITEFIELD CHASE.—The subject is treated in detail and gives valuable information..... 18047

IX. ILLUMINATION.—The Automatic Ignition of Gas..... 18044

X. LOCOMOTIVE ENGINEERING.—Tests of the Strong Balanced Locomotive at Purdue University.—An article of great interest, giving a detailed description of the elaborate series of tests.—12 illustrations..... 18042

XI. MEDICINE AND HYGIENE.—Snuff Inebriety..... 18049
Do We Take Too Much Acid Food?..... 18049

XII. METALLURGY.—The Utilization of Aluminum in the Arts.—The first installment of a valuable paper..... 18045

XIII. MINERALOGY.—Utah Uintaite Deposits.—A description of the new mineral used in varnish making, etc..... 18052

XIV. MISCELLANEOUS.—The Strength of Ladders.—A unique paper giving the results of a series of ladder tests..... 18044
Are Men of Genius Degenerates?..... 18054
Engineering Notes..... 18045
Electrical Notes..... 18045
Selected Formulæ..... 18045

XV. NATURAL HISTORY.—The Reproduction of the Eel.—By HENRY DE VARIGNY, in La Nature.—1 illustration..... 18052
The Theater of Insects.—By JOHN H. LOVELL..... 18051
The Iguanas in the Zoo at Leipsig.—1 illustration..... 18051

XVI. ORDNANCE AND ARMOR.—A New System of Throwing High Explosives.—By HUDSON MAXIM.—A most interesting paper, giving details of a new and elaborate system of throwing high explosives which bids fair to revolutionize modern navies.—20 illustrations..... 18040

EXTENSION OF OUR SOUTH AMERICAN TRADE.

Judging from the geographical standpoint, it must be admitted that the trade of the South American states belongs to the United States and should be controlled by them. As a matter of fact, however, the export and import trade is chiefly in the hands of German, English, and French houses, which supply most of the manufactured products called for in these countries. It must not be supposed that the relative scarcity of American trade is due to any superiority in the goods manufactured in European countries. The paucity of our trade is explained by the fact that we have comparatively very little commercial representation in these states. It is the practice of other countries to maintain exhibition centers, where their goods are always on view, and these are superintended by expert salesmen who are thoroughly in touch with the wants of the community and keep their wholesale houses continually informed of its needs.

We have already drawn attention to the efforts of the National Association of Manufacturers of the United States to establish at Caracas, Venezuela, a depot for the exhibition of sample American goods, and we are glad to learn that the enterprise is now being established on a firm basis.

The government of Venezuela has given material assistance by rescinding the duty on goods which are brought for purely exhibition purposes, though, should the goods be subsequently sold, the duty would, of course, be collected. One of the leading steamship lines has also agreed to reduce the rates one-half on all goods that may be shipped for exhibition. The charges for exhibition space will be such as are necessary to cover the current expenses, exhibitors being charged from two to five dollars per square foot per year. Great care will be exercised in the selection of salesmen, and the management will favor the employment of men who are thoroughly conversant with the country, its people and its needs. We very heartily commend this enterprise to the attention of American manufacturers. It is certainly the most practical way to attack the problem of opening the doorway for our surplus product into this hitherto much neglected field.

THE PROPOSED RAPID TRANSIT TUNNEL, NEW YORK CITY.

The commission of three appointed by the Appellate Division of the Supreme Court to report upon the tunnel railroad proposed by the Rapid Transit Railroad Commission of New York City is now engaged in taking testimony from the commissioners, the chief engineer, and the property holders along the route of the road. The data furnished by the engineer places the prospects for building the road in a better light than they have presented at any time since the original scheme was first mooted. The present amended plans were illustrated and described in the issue of the SCIENTIFIC AMERICAN SUPPLEMENT for November 21, 1896, at the time when they were first drawn up. In the interval more extensive surveys have been made, and the latest estimates show that the probable cost of the road will be even less than that originally estimated for the amended scheme.

According to the present plan, a trifle over twenty miles of road will be built. This will reach from the Post Office to the Kingsbridge Station on the west side, and to Bronx Park and the Boston Road on the east side. Although this is about two miles longer than the route first proposed, known as the Broadway route, it involves two miles less of four-track tunnel. The estimated cost of the route which was vetoed by the Appellate justices was about $50,000,000, whereas the estimated cost of the present proposed route beneath Elm Street will not be over $32,600,000. This total, however, will be considerably reduced if the commissioners persist in their decision not to put up any pipe galleries at their own expense, and to replace the proposed enameled-brick tunnel lining with painted cement concrete—a change which will probably be made. This would effect a saving of about two and a half million dollars, and would reduce the cost of the completed tunnel to something under $30,000,000. The preliminary borings which have been made through Center Street, Elm Street, Fourth Avenue and the district beyond, indicate that the work of excavation will be easier than was at first anticipated.

The fact that this great and much needed public work can be built for such a reasonable sum (nearly one-half less than the probable cost of the Broadway scheme) will remove a considerable part of the opposition which the scheme originally aroused. Next to this the greatest difficulty to be overcome is the prejudice which will naturally exist against any underground system of transit. Regarding this, it must be admitted that the question is one of a choice between two difficulties. The public must either be content to submit to the overcrowding and general inconvenience of the present overloaded facilities or it must take the tunnel with its comparative darkness and other imaginary discomforts. Judging from the success of underground transit as carried out on modern lines, it is almost certain that the enlarged accommodation and the high speed which would be realized in the new tunnel would very quickly reconcile the New York citizen to the fancied inconveniences of this mode of travel.

DECEPTIVE METHODS OF PATENT ATTORNEYS.

The general discredit which the practice of certain patent attorneys has cast upon the Patent Office and the profession, by reason of their peculiar crooked methods and deceptive advertisements, is greatly to be deplored, since it is likely to create in the minds of many well meaning inventors a lack of confidence in all attorneys, however honorable a reputation they have borne in the past. The activity, however, of the present Commissioner of Patents, the Hon. Benjamin Butterworth, in taking measures to raise the standard and morale of the office, and by examining into the methods of John Wedderburn & Company, charged with pursuing fraudulent methods in patent practice, is greatly to be commended and will doubtless receive the approval of all inventors.

We believe there has never been before the Patent Office a case of such magnitude as that now pending before the Commissioner, in which is disclosed by the evidence, a surprising system of misrepresentation and equivocation designed for the deception of inventors.

According to the evidence as brought out at the examination by Assistant Commissioner Greeley, who has been assigned by the Commissioner to conduct this investigation, it appears in a large percentage of cases it was the custom of the firm in question to render favorable reports and send misleading letters to inventors of clearly unpatentable inventions. When the inventor responded and the application was lodged in the Patent Office, he was usually rewarded with a silver medal. Upon the absolute refusal by the Patent Office of a patent the inventor was advised that serious objections were raised against the granting of a patent, which might be overcome if an appeal was taken to the Board of Examiners in Chief, and further fees were asked for. If the amount was forthcoming, in numerous cases very little or no effort was made by argument, and usually the decision of the examiner below was affirmed, of which the inventor was seldom notified, but on the contrary was apprised of the probable remarkable value of the invention, estimated at various sums from $5,000 to $20,000, and was urged to secure foreign patents. He was further requested to remit another sum for the purpose of advertising the invention and having a sketch of himself written and published.

Thus by an extensive system of flattery and misleading correspondence, combined with medals or prizes, the inventor was led into the belief that his unpatentable invention was patentable and likely to bring to him a fortune.

Whatever may be the outcome of the proceedings instituted by the Commissioner of Patents, one excellent result is already manifest in the fact that fraudulent and crooked methods of securing patents have been in a measure checked, and the aspersions cast upon reputable attorneys nullified. There should be brought about soon a wholesome restoration of confidence between inventors, attorneys and the administration of the Patent Office, which should be of lasting benefit to all.

PROSPERITY.

The prolonged period of business depression, which may be said in a general way to have lasted since 1892, appears at last to have come to an end, and from almost every quarter and in nearly all lines of business we hear most encouraging reports. We think there will be general unanimity in finding the principal factors of the depression of the past four years in three main causes—the difficulty in repealing the silver purchase act, and the consequent doubts as to the stability of the currency, and the two successive tariff acts, with the disturbance they have caused to trade and manufacture. Whatever may be the merits or demerits of the tariff just enacted, it is a great thing for business that the subject is now out of the way, probably for three or four years, at the least, and it is extremely fortuitous that, just as this most vexatious matter ceases to cast its shadow over the business world, we are come upon a period of good crops and advancing prices for the farmer. The grain crops of the rest of the world are below their usual average, while our wheat crop is considerably above the average, and, with a surplus of corn from last year, we shall have large supplies to market at figures which have been steadily advancing for the past three months, and do not yet appear to have reached their limit. So, too, it is predicted that this year's cotton crop will be the largest one ever raised. The trunk line railways are all making preparations to handle a very heavy business, which will test the capabilities of their entire rolling stock.

The improvement in trade and manufacture, stimulated and supported as it necessarily is by the excellent crops, which must always afford the backbone of a healthy prosperity, is also largely due to the increasing confidence of business men and capitalists that nothing

will be practically effected by those who have been so long working to debase the currency of the country. The best evidence of the hopelessness of their task is to be found in the steadily declining price of silver, and, although the silver agitation may continue for some time yet, the possibility of its again becoming a vital issue grows more distant with each improving feature of the business situation. Confidence is of slow growth, but it is evident that it is now the dominant feature in business circles generally.

A SUCCESSFUL SOLUTION OF THE LOCOMOTIVE COUNTERBALANCE PROBLEM.

The Purdue University locomotive testing plant has recently concluded a series of tests which will rank high in interest and value among the many which have been carried out since it was first put in operation. As most of our readers are aware, the apparatus has been designed for the purpose of subjecting full sized locomotives to test under conditions which shall be as far as possible identical to those which obtain in actual service on the road, and the data which is so secured has the double value of a trial which is at once practical and scientific—all the possibilities of error being eliminated with the care which distinguishes laboratory work.

The tests to which we refer were carried out upon a locomotive which was designed for the purpose of overcoming the old-time and apparently insuperable difficulties attendant upon counterbalancing. What these difficulties are is so well known as scarcely to call for repetition here; but the effects of faulty counterbalancing are not so generally appreciated. How destructive these effects may be, how costly to the railroad companies in repairs both to rolling stock and to track, may be judged from the fact that a poorly balanced freight engine running at high speed over a stretch of track has been known to bend the steel rails into a series of hollows, and in some cases break them altogether.

The counterbalance difficulty arises from the impossibility of balancing the moving parts (crank pins, connecting rods, pistons, etc.) which are attached to the driving wheels, so that the center of gravity of the wheels and the attached parts shall coincide with the axis of the wheels. The revolving parts (crank pins, part of connecting rods, etc.) may be balanced to a nicety by placing weight on the opposite side of the wheel; but the reciprocating parts (part of connecting rod, the crossheads, piston rods and pistons) cannot be so balanced for the entire revolution of the wheel. For if, after the revolving parts have been provided for, counterbalance weights be added whose momentum will be equal to the momentum of the reciprocating parts when the latter are at the half stroke and traveling at their greatest speed, it is evident that when the crank is on the dead center and the reciprocating parts are at rest the whole momentum of this counterbalance will be "in excess," as it is called. This excess will increase the pressure of the wheels on the rails on the downward half of the revolution and reduce it on the upper half. Theoretically we should expect that a speed would be reached where the upward momentum would exceed the tension of the springs, causing the wheels to jump clear of the track at each revolution. It was suspected that this variation of pressure of driving wheels on the rails occurred in practice, and the various tests at Purdue University have shown that such alternate "hammering" and lifting actually takes place.

If all the reciprocating parts are balanced, there will be destructive vertical hammering; if none is balanced, there will be longitudinal disturbance, producing an uncomfortable tremor throughout the train and badly racking the locomotive. To meet the difficulty, or rather to moderate it, locomotive builders have taken a middle course, and, while balancing all the revolving parts, they have balanced only a portion—usually 70 per cent—of the reciprocating parts. This results in an excess balance of from 400 pounds in the average engine to as high as 800 pounds in some recent heavy compounds. This, in the latter case, is equivalent to the vertical effect of fastening nearly half a ton of metal eccentrically within a wheel which is revolving at the rate of 300 or 400 revolutions per minute. It is little wonder that rails are bent or broken and that the locomotive repair bill is often so heavy.

In the locomotive which has recently been tested on the Purdue plant the difficulty is overcome by the use of four cylinders. These are arranged so that each pair of engines on either side has its cranks set 180 degrees apart, and the reciprocating parts are made to exactly counterbalance each other. A full description, with illustrations, of this engine was published in the SCIENTIFIC AMERICAN and the SUPPLEMENT respectively for November 14 and November 21, 1896. Without going into details, it is sufficient to say that the reciprocating parts of the low pressure engines were designed so as to be of the same weight as those of the high pressure engines, and by placing the cranks at 180 degrees, as stated, the counterbalancing dilemma was entirely removed. In the current issue of the SUPPLEMENT will be found a digest of the test as carried out by Prof. Goss, of Purdue University. It consisted in running a set of wires between the locomotive drivers and the supporting wheels on which they turned, the theory being that the wires would be flattened in proportion to the pressure to which they were subjected during a revolution of the drive wheels. If the pressure was even, the wire would be even in thickness; if it varied, the thickness of the wire would vary proportionately.

In the tests which had previously been made on the Schenectady experimental engine, which carries an excess balance of 400 pounds, the wire, after passing under the drivers, showed great variations in its thickness, which increased where the counterbalance in the wheel approached the upper quarter of its revolution until its full diameter was reached, "a condition," says Prof. Goss, "which continues through several feet of its length and makes plain the fact that the wheel must have risen clear of its support during a considerable portion of its revolution."

On the other hand, the wires from the balanced locomotive were "nearly of the same thickness throughout."

The report concludes by stating that the data of the test justify the conclusion that the drive wheels of this locomotive "are at all times in perfect balance, that they neither increase nor diminish the pressure with which they act upon the rails as they revolve."

This very creditable result goes to prove that many of the so-called inherent drawbacks of some of the most familiar mechanical appliances are not inherent at all, and may be made to yield to an intelligent treatment of the problem. If it is objected that the new system of balancing involves the use of four cylinders and a multiplication of parts, the question becomes one of expediency and relative cost. The present practice of turning out locomotives carrying an excess balance is admitted to result in a more or less destructive action upon the track and bridges. Not only so, but it shortens the life of the locomotive itself. The Purdue tests indicate that the wear and tear of the track from this cause must always be considerable, and that under locomotives having a considerably greater excess than the 400 pounds carried in the test, and running at high speed, it must be enormous.

To what extent does the cost of repairs to track and locomotives due to excess balance in the present type of locomotive exceed the extra cost of a four cylindered locomotive of the same weight and power? This is a question which may well be commended to the thoughtful consideration of the roadmaster and the master mechanic.

OFFICIAL REGISTRATION OF PATENT ATTORNEYS.

We have commented before on the need of more stringent requirements by the Patent Office of persons who desire to practice there in the rôle of attorneys than has heretofore existed, in consequence of the fraudulent practices that have been permitted with regard to applications for patents and their subsequent prosecution. The need of reform in the patent bar, if there is such a thing, has been evident for a long time.

We therefore are glad to note that a step in securing such reform, and which should soon exert an elevating influence on those engaged in soliciting patents, as well as give renewed assurance to the public that it will be honorably and honestly treated, is the new order and amendment to the Rules of Practice, promulgated August 6, 1897, by Hon. Benjamin Butterworth, Commissioner of Patents, which requires a register of attorneys to be kept at the Patent Office. The amendment is so important that we herewith give it in full:

"DEPARTMENT OF THE INTERIOR,
"UNITED STATES PATENT OFFICE,
"WASHINGTON, D. C., August 6, 1897.

"Rule 17 of the Rules of Practice, approved June 18, 1897, is amended to read as follows:

"17. An applicant or an assignee of the entire interest may prosecute his own case; but he is advised, unless familiar with such matters, to employ a competent attorney, as the value of patents depends largely upon the skillful preparation of the specification and claims. The office cannot aid in the selection of an attorney.

"A register of attorneys will be kept in this office, on which will be entered the names of all persons entitled to represent applicants before the Patent Office in the presentation and prosecution of applications for patent. The names of the following persons will, upon their written request, be entered upon this register:

"(a) Any person who at the date of the approval of the present Rules of Practice, June 18, 1897, was engaged in the active prosecution as attorney or agent of applications for patent before this office, or had been so engaged at any time within five years prior thereto and is not disbarred, or is or was during such period a member of a firm so engaged and not disbarred, provided that such person shall, if required, furnish information as to one or more applications for patent so prosecuted by him.

"(b) Any attorney at law who is in good standing in any court of record in the United States or any of the States or Territories thereof, and shall furnish a certificate of the clerk of the United States, State, or Territorial court, duly authenticated under the seal of the court, that he is an attorney in good standing.

"(c) Any person who has been regularly recognized as an attorney or agent to represent claimants before the Department of the Interior or any bureau thereof and is in good standing, provided that such person shall furnish a statement of the date of his admission to practice as such attorney or agent, and shall further show, if required by the Commissioner, that he is possessed of the necessary qualifications to render applicants for patents valuable service and is otherwise competent to advise and assist them in the presentation and prosecution of their applications before the Patent Office.

"(d) Any person not an attorney at law who shall file a certificate from a judge of a United States, State, or Territorial court, duly authenticated under the seal of the court, that such person is of good moral character and of good repute and possessed of the necessary qualifications to enable him to render applicants for patents valuable service and is otherwise competent to advise and assist them in the presentation and prosecution of their applications before the Patent Office.

"(e) Any firm which at the date of the approval of the present Rules of Practice was engaged in the active prosecution as attorneys or agents of applications for patents before the Patent Office or had been so engaged at any time within five years prior thereto, provided such firm or any member thereof is not disbarred, provided the names of the individuals composing the firm are stated, and provided, also, that such firm shall, if required, furnish information as to one or more applications prosecuted before the Patent Office by them.

"(f) Any firm not entitled to registration under the preceding sections who shall show that the individuals composing the firm are each and all recognized as patent attorneys or agents or are each and all entitled to be so recognized under the preceding sections of this rule.

"The Commissioner may demand additional proof of qualifications and reserves the right to decline to recognize any attorney, agent, or other person applying for registration under this rule.

"Any person or firm not registered and not entitled to be recognized under this rule as an attorney or agent to represent claimants generally may, upon a showing of circumstances which render it necessary or justifiable, be recognized by the Commissioner to prosecute as attorney or agent a certain specified application or applications; but this limited recognition shall not extend further than the application or applications named.

"After January 1, 1898, no person not registered in accordance with this rule will be permitted to prosecute applications before the Patent Office.

"BENJAMIN BUTTERWORTH, Commissioner.

"Approved:

"THOMAS RYAN, Acting Secretary of the Interior."

The advantage of this rule to the general public is that before intrusting business to an attorney a person may ascertain from the Commissioner of Patents whether such attorney is on the Patent Office public register. An affirmative answer would convey the inference that the attorney could be depended upon to deal with his client honestly—an assurance which is now lacking, yet which should in the future bring the patent practice up to a higher and better level. All reputable attorneys should at once endeavor to have their names registered and assist in establishing this needed reform. Commissioner Butterworth certainly deserves the thanks of the public and of the patent attorneys in particular for the promulgation so promptly of this excellent amendment.

Ocean Voyage by a Stern Wheel River Steamer.

We are informed by Frank S. French, of San Francisco, Cal., that during the past month insurance and seafaring men have been speculating as to the outcome of the proposition to bring a stern wheel river boat, the H. C. Grady, down the coast from Astoria, Ore., to San Francisco, Cal.

At a glance it will be seen that a flat-bottomed, top-heavy and unwieldy craft, built to run on smooth water, with guard scarcely two feet above the water, and further encumbered by a heavy stern wheel, is not a very inviting risk either to underwriters or crew when a voyage of the better part of a thousand miles down a treacherous coast is to be undertaken.

After many delays a start was made, and for five days this unseaworthy hulk battled against head winds and high seas, but to the surprise of many actually succeeded in making port under her own steam. The success of the venture is largely due to the skill of the master, Capt. Denny, an old-time sea captain, well known on the Pacific coast.

It is doubtful if a stern wheel steamer of this class ever made an ocean voyage before, unassisted by other vessels.

ACCORDING to experiments recently conducted by Messrs. Holborn and Wien, the electric resistance of platinum theoretically sinks to 0 at —258° Centigrade.—L'Industrie Electrique.

RAILWAY MAIL CATCHER AND DELIVERY DEVICES.

In continuance of our notice of railway mail catcher and delivery devices we present the accompanying illustrations of the Ayars mail catcher and receiver. Of these Fig. 1 shows the apparatus as attached to the side of the mail car, and Fig. 2 is a side and rear view of the iron mail receiver as set up alongside the track. The catcher is attached to the outside of the car on one side of the door by means of a plate which is securely bolted thereto. Another plate on the opposite side of the door carries the shafting and gear of the deliverer, which is capable of swinging outwardly through a quarter circle, and is held in the outward position by means of lugs or stops. Upon the outer end of the delivery arm is pivoted a tripping device, as will be later described. At the upper end of the vertical shaft upon which the deliverer is keyed is mounted a gear segment which meshes with a similar gear segment on a horizontal shaft which extends along the side of the car toward the doorway. The shaft is rotated in its bearings by the hand bar attached thereto at right angles as shown in Fig. 1, thereby causing at the same time the delivery arm to swing out from the car or return to its original position. This shaft is carried in bearings cast on the plate on which the deliverer is carried, and the end opposite the door opening is carried within the hollow end of the large arm of the mail bag catcher. The catcher is supported by its connection with this shaft at one end, and at the other end it rests in a bearing secured to the side of the car in front of the door, where an adjustable collar is provided to limit its forward movement. The usual buffer is provided at the rear of the catcher to receive the impact of the bag. The end of the horizontal shaft which operates the delivery arm is flattened where it enters the hollow shaft of the catcher, and a transverse opening in the latter receives a flat pin which serves to lock the shaft and the catcher arm so they shall rotate together. The handle above mentioned on the catcher opposite the catching hook is in such a position as to lie flush with the side of the car when the catcher is not in use. When the train is approaching the receiver, this handle is pulled down into a horizontal position within the car, the hook arm being carried then into a horizontal position and placed in line with the bag which is to be caught. The same movement of this handle turns the horizontal shaft and the vertical shaft by means of the gear before mentioned and swings the horizontal arm, with the mail bag attached, out to a horizontal position, bringing the bag into the proper position for delivery. The releasing of the bag is accomplished by means of an automatic cast-off device which is operated by means of a striker on the mail receiver, as will be later described.

Fig. 1.—THE AYARS DELIVERER ARM AND CATCHER IN POSITION.

The receiver, which is built usually on an extension of the ties of the railroad track and is securely bolted to them, is a metal structure of the kind shown in illustration, Fig. 2. A little in advance of the mouth of it a small crane is erected which carries a series of pendent strikers. These are suspended at such a height that they will just strike the tripping lever on the cast-off or release device before mentioned, and they are made in separate pieces in order to lessen the weight of the blow when the train is traveling at a high rate of speed. The strikers may be made of very light weight, as it requires but little force to release the catch. The fingers of the release device are ingeniously designed to cause the bag to drop the moment the lever of this device is pushed slightly backward. The side of the receiver consists of wire netting. It is built of sheet iron and is curved somewhat to a cycloidal form, as this form is best adapted to bringing the mail bag to a state of rest gradually, and with least injury to its contents. Just to the rear of the receiver is a stout wooden crane with a swinging cross bar, and when mail is to be delivered to the train the cross bar is drawn down into a horizontal position and the mail bag suspended from it.

At stations where there is no receptacle for mail it will not be necessary to use the delivery arm on the car, and to enable the mail clerk to use the catcher alone, it is only necessary to withdraw the small pin before mentioned, which locks the catcher to the deliverer. This will allow the delivery arm to remain locked against the side of the car while the catcher is swung out into position. The operation of catching and delivering mail is as follows:

On approaching a mail station the clerk hangs the mail bag upon the holder while the delivery arm is projecting into the door opening. As the station is approached he pulls down the handle of the catcher, thereby swinging the delivery arm out into position. When the station is passed the catcher will, of its own accord, swing down into normal position and turn the delivery arm in against the car, where it may be securely locked. This very interesting and effective device has been thoroughly tested by the Erie Railroad Company at Lake View, N. J., and also by the New York and New Haven Railroad, at New Haven, Conn., and we are informed that the management of both these railroads have expressed their unqualified approval of the device. Special advantages claimed by this form of catcher and deliverer are that the receiver is always set and requires no attention before the arrival of the train; that there is no violent contact of metal against metal to cause ultimate breakage and necessitate repairs, and this device involves no risk to the mail clerk as compared with others, for the reason that it is not necessary for him to hold down the catcher handle after the delivery arm has been thrown out.

As an instance of the facility with which mail may be received and delivered along the route, attention is drawn to its trial on a division of the Pennsylvania Railroad at three stations, between which the distances were respectively 0·8 of a mile and 1⅛ miles. The mail train passes these three stations at the rate of sixty miles per hour, and as the road is on a down grade at this point the trains frequently go by at a speed of seventy miles an hour. In spite of the brief interval of time between stations, the mail clerk has no difficulty in locking the pouches and attaching them to the deliverer.

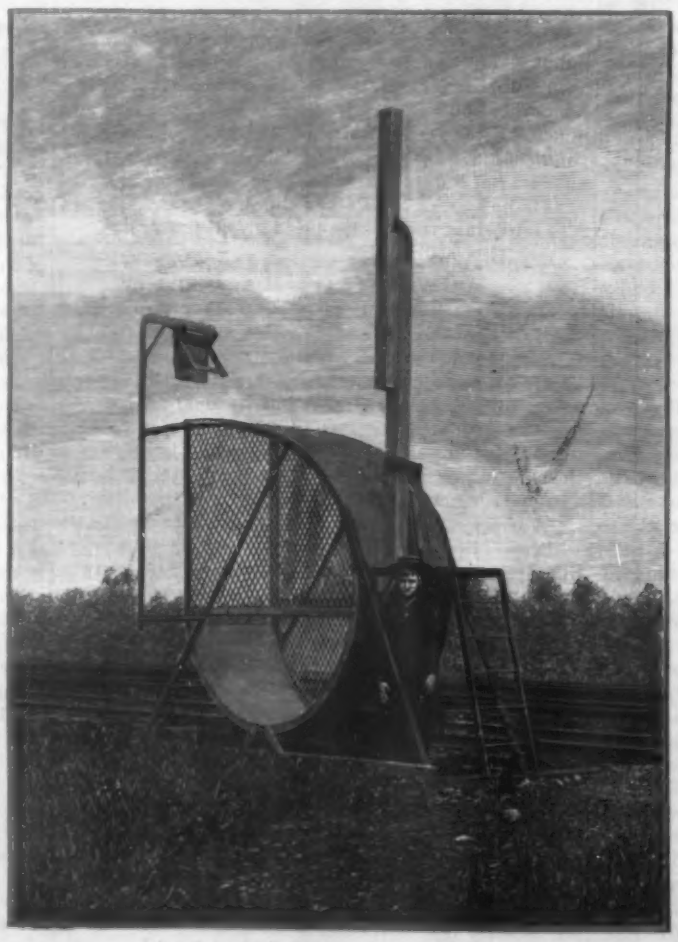


Fig. 2.—THE AYARS MAIL RECEIVER.

Climbing the Rockies.

The terrible Jungfrau of Switzerland is but 14,000 feet high, yet travelers from all over the world journey to Interlaken to climb it, or to say that they have sat in the hotel and wished that they might climb it. Mont Blanc, in the same delightful little European republic, is forever quilted with snow, and for this reason it is one of the most seductive features of travel in the neighborhood of Geneva. The Chor health resort, on the east side of the Swiss republic, is visited by thousands of invalids, because it is one of the loftiest and noblest of European sanitariums.

Then why should not, says the Denver Times, every American who has money to spare and the desire to make a journey get out into Colorado, strap a pair of mountain boots on to his legs, put a spigot on an ash staff and attempt to climb Mount Blanca in the southern part of this State? Mount Blanca is over 14,400 feet high. Or, if he does not care to take the risk of this perilous ascent, why should he not come up into the northern part of the State, place his field glasses in his hands and gaze on the glacier and the perpetual banks of snow that cover Mount Hallett? Or, if tourists be possessed of reverence or of piety, why may they not locate in Central Colorado, and fix their eyes upon the great white cross that indents the Mount of the Holy Cross at an elevation of 14,176 feet?

If it is the duplicate of Chor that tourists seek, Manitou, in this State, rests at the foot of 14,000 foot Pike's Peak for them, and is itself 6,300 feet above the sea, while being endowed with health-giving waters the equal of Carlsbad.

There are 110 mountains in Colorado whose peaks are over 12,000 feet above the ocean level. Forty of these are higher than 14,000 feet, and more than half of that number are so remote and so rugged that no one has yet dared to attempt to climb them. They are as unique as those of Switzerland, and as fearful as the Alps in the warning they offer to men and women who are so hardy as to defy them by starting upon their ascent. Some of them are massed with snow, others have glaciers over their approaches, and others are merely masses of jagged rocks.

Not even Coloradoans have sought as yet to surmount them, and the profession of "guide" is still open for whoever may care to enter it. Railroads reach within close enough range to provide hotel facilities, but otherwise the mountain climbing of Colorado is awaiting its pioneers. Did the Coloradoans or the people of the State fully realize the intoxication as well as the health-giving powers of mountain climbing, Rocky Mountain climbing would be one of the popular recreations of America.

Only one mountain climbing club is known to exist in Colorado. There is room for a dozen more. There should be one in every city. By the evidences such clubs might offer of their thrilling experience and unexampled pastimes, the fame of the Rockies as a place of pleasure and adventure might be widely advertised, and Colorado thus be pushed forward to the place it must eventually occupy as the American substitute for Switzerland.

THAT the water of the sea contains gold, among other metals, is perhaps well known. According to Tont Savoir, quoted by the Revue Scientifique, which gives a summary of the data that have been obtained in regard to this subject, Sondstadt, in 1872, reached the conclusion (confirmed more recently by Munster) that the "briny deep" contains about one grain of this metal to the ton of water. One grain is not much, but this figure has its value when we take into consideration the immense extent of the oceans, which, as a whole, would, at this estimate, contain a total of 10,250,000,000 tons of gold. This latter is found in the state of iodide, and the iodide that enters into the combination would amount to something like 4,428,800,000,000 tons.

AIR BRAKE INSTRUCTION CAR ON THE "BIG FOUR ROUTE."

Railroad men are justly proud of the splendid organization which distinguishes the operations of the great railroad systems of the United States. With the possible exception of the army and navy, there is no sphere of human activity where the necessity and advantage of order and method have been recognized and realized more fully than in the control of the finances, the equipment and the large army of employes of our first-class modern railroad system.

If one were asked to name the department where these features are most necessary and conspicuous, he would probably select that which is in charge of the superintendent of motive power; for it is upon the efficiency of this department that the safety of the public and the profit of the shareholders depend to a degree that characterizes no other branch of railroad service.

During the past dozen or fifteen years there has been a steady advance in the men and methods of this department. The employes are more thoroughly trained, and greater care and better judgment is used in selecting candidates for promotion. Greater effort is made to give the employes instruction in the theory and use of the plant and equipment which is intrusted to their care. A premium is put upon education and intelligence, at least so far as it relates to the work of this department, and a green hand is encouraged to do something more than merely "catch on" to the mechanical handling of the equipment—he is expected to acquire a knowledge of its parts, so that in cases of break-down he may be able to locate the difficulty and not be entirely dependent upon the round house or the repair shop.

By the kindness of Mr. William Garstang, superintendent of motive power on the Cleveland, Cincinnati, Chicago and St. Louis Railway, familiarly known as the "Big Four Route," we are enabled to illustrate the interior of the air brake instruction car used on that system. The car was specially built, as its name implies, for the instruction of the train crews on the road. To this end it is fitted up with a complete, full-size train equipment, such as the air brake, the steam heating apparatus and the lighting equipment, as further explained below. Externally the car is of the standard style and color of the first-class coaches on this system. It is 54 feet long on the inside and is finished in ash and walnut. It is divided into two compartments, one of which is carpeted and is used as an office and reception room. This is furnished with a desk, chairs, one lower and one upper berth, the former being of the portable lounge pattern, and there is also a wardrobe and toilet.

The other and larger compartment forms the lecture room, which contains the Westinghouse and American air brake appliances, full size. It is furnished on one side with a long row of cane-seated chairs for the use of the instruction class. On the opposite side, next the office, is the complete air brake equipment of two locomotives (one 8-wheeler and one 10-wheeler), and also complete driver-brake models, driven by a small motor and made to operate in conjunction with the other appliances. Then, in their order, down the side of the car, are one passenger car and six freight car equipments, complete with all pipe fittings and hose cocks in their regular position, the same as upon a train of the same length. To compensate for the shorter pipes, the full brake-pipe volume on each car is represented by small reservoirs which are placed out of sight. This apparatus is placed on the wall in such a way that each car equipment is separated from its neighbor by a window which affords plenty of light and ventilation. Directly above each appliance is a large photograph indicating the design of vehicle for which the appliance is intended.

At the opposite end of the car from the office is an upright boiler and a coal bunker, which are partitioned off from the lecture room by folding doors, an arrangement which prevents heat, noise and dirt from entering the main room, and, at the same time, gives easy access for repairs and cleaning. Adjoining this partition is the 8 inch pump which supplies the air, and this, with the duplex boiler feed pump, is supplied with the necessary drainage. Mounted on pedestals and placed on a strongly built table are a set of cut sections of air valves, painted red. There are also cut in sections a 9½ inch air pump mounted on a revolving pedestal, an entire freight car brake and a Nathan No. 9 injector, triple sight feed, nickel plated lubricator and a Gold Car Heating Company's steam heat apparatus for locomotives and cars. There is also a working model of the latest improved Leach sanding device.

AIR BRAKE INSTRUCTION CAR LOOKING TOWARD BOILER ROOM.

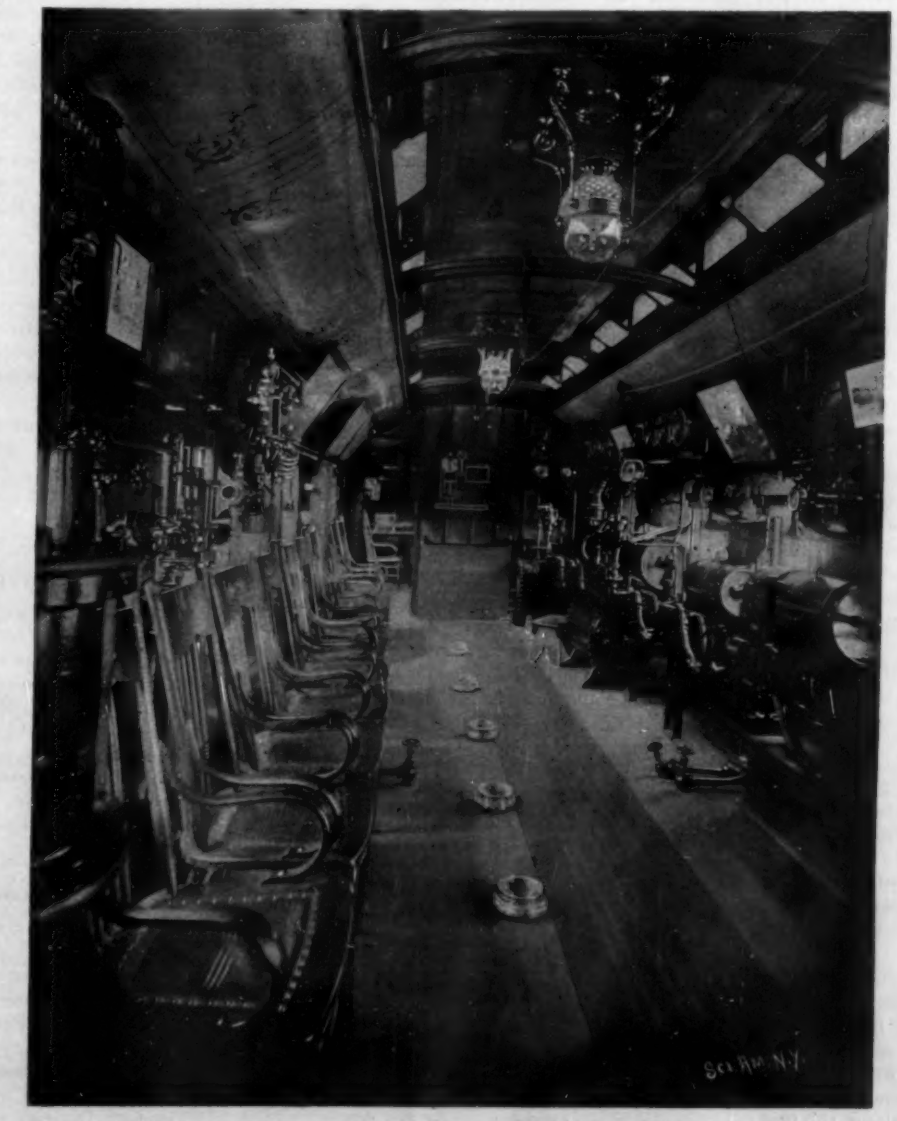
In a large case are six blackboards, each containing working templates of all the air valves, pump valve motion, Hodge & Stevens brake foundation gears, diagrams, etc., which are used in the elementary lessons and referred to in explaining mechanical effects.

The car is equipped with Pintsch gas fixtures, having four 4-flame lamps in the body of car and two side bracket lamps, one over the instructor's desk in office room and the other in front of the steam gage at boiler. The lamps are supplied by two gas receivers, which, together with the water tanks, are placed beneath floor and in such position as to cause proper distribution of weight to all springs. The car is heated with the Gold system of steam heat, supplied with the standard valves, gages and traps, but so arranged as to return the condensed steam to its own water tank. The car's steam heat, signal and air brake foundation appliances are connected with those in the instruction room and used in this connection.

The plan of operating the car is to have it go from one division point to another, where previous notice has been given, and those whose duties bring them in contact with such appliances are requested to attend the lectures as often as possible during its stay. Classes of twelve each are instructed and examined, and certificates of proficiency are issued by the instructor to each individual and a duplicate sent to his superior officer. The men all take a lively interest in the matter, some to the extent of laying off their runs and taking a regular course. The latter, in addition to greatly increasing their knowledge and their record of attendance, obtain a higher grade of certificates, etc., due recognition of which is made by the company when choosing from the ranks for promotion.

In designing the car, care has been taken, not only to have the apparatus of instruction completely and conveniently shown, but also to make the car comfortable for those giving and receiving instruction. Attention, therefore, has been paid to light, ventilation and seating capacity, and those in attendance are not obliged, as is frequently the case in cars of this sort, to stand crowded together during the lecture and to endure the heat of the boiler as well as the inconvenience of standing.

The car is in charge of Mr. W. J. Hartman, who for six years traveled for the Westinghouse Company as instructor and expert, and previously was instructor of engine and boiler management at the Rose Polytechnic Institute, Terre Haute, Indiana. We are informed that the car has already made one tour over the system, in the course of which some 3,000 men received instruction with results which have been very satisfactory to the company.



AIR BRAKE INSTRUCTION CAR LOOKING TOWARD OFFICE.

IT has been known for some time that red hot iron is pervious to carbon dioxide. M. Gréhant has found by experiment that the carbon dioxide does not only freely pass through the iron, but is decomposed, carbon monoxide being set free. This may account for some of the accidents which the monoxide has caused. Rooms must not be heated by a red hot iron stove.—Revue Industrielle.

Saving a Town and Cape.

BY GEORGE STHELBERT WALSH.

The Harbor and Land Commissioners of Massachusetts are making systematic efforts to reduce the danger and prevalence of sand storms which sweep across Cape Cod whenever a high wind blows up from the sea, and incidentally to protect Provincetown from threatening destruction. There is probably no immediate possibility of Provincetown being overcome by the sand; but if the encroachment of the belt of sand upon the wooded section next the harbor and town should be allowed to continue undisturbed for the next half century, the place would be depopulated. It is not the first time that the inhabitants of Provincetown have been compelled to exert themselves to stop the encroachment of sea and sand. Many years ago it was made compulsory by law for the citizens of Cape Cod to turn out every spring and plant marram grass to shut out the sea, and Provincetown owes its existence to-day to wise laws which empowered a "beach grass committee" to enter any man's inclosed garden or field and plant marram grass, if the sand was uncovered or movable.

The purpose of the Harbor and Land Commissioners now is to make the work of laying the sands permanent and endurable. Most of the land troubled by the drifting sand storms is owned by the State, and it is only just that the State should perform the work for which Provincetown has so long been held responsible. The tract of land comprises between 3,000 and 4,000 acres on the extreme northerly point of the cape, and it was purchased by the Colony of New Plymouth from the Indians in 1692. The land faces the Atlantic Ocean on one side, and stretches back to a belt of woods, which the early inhabitants of Provincetown planted to protect their town and harbor from the sand storms. Recently, however, the sand belt has been steadily encroaching upon the wooded tract, and it is to prevent the destruction of work already accomplished that the commissioners have set out to reclaim the sandy beach from the sea and wind.

A sand storm on Cape Cod, back of Provincetown, is something more to be dreaded than a Western blizzard. When the wind blows in a gale from the northeast the soft, light sand drifts in immense clouds, completely obscuring all objects around further than ten feet away. It is worse than snow in many respects. It not only covers up the road or trail in a short time, but it changes the general features of the landscape permanently. People get lost in the sand storms, and often, when the storm subsides, the landscape is so altered that they are bewildered and puzzled in trying to locate their homes. The sand may not be as freezing cold as the snow, but it is far more injurious. It cuts and grinds the face as it strikes it, and performs about the same operation as a sandblast. Men who have been lost out in the furious sand storms, and members of the life-saving patrol, have returned home at night with their faces lacerated and discolored so that they resembled raw beef. Even the glass windows of the houses are so ground by the flying sand that they have to be replaced often by new ones. After one heavy storm it is almost impossible to see through the glass. People now shut the blinds of the houses facing the wind during sand storms in order to save the glass. No man can face the sand clouds and endure the pain for long.

As the prevailing sea winds are from the northeast on the cape, the sand dunes are drifting steadily and persistently toward Provincetown. The reclaimed belt of woods is thus in imminent danger of destruction and burial. This growth of woods is unmistakably very remarkable for a sandy beach, and the variety of plants and trees is a genuine surprise to every botanist who visits the region. The commissioners cite this condition of affairs as good evidence that the sand is very fertile if once held in place, and that their scheme of reclaiming the rest of the beach is not only feasible but eminently practical. The black oak, pitch pine, and beech are the leading trees that have obtained a sturdy growth on the beach; but underneath them there is a most interesting flora of smaller plants. The privet, bayberry, and wild rose especially predominate. In the summer time the woods are gay with rich colored wild flowers that carpet the ground and hang in festoons from the trees and bushes.

An appropriation of $3,000 was obtained by the commissioners in 1894 to experiment with their work on the cape, and in the two following years appropriations of $3,500 each were obtained. When the first appropriation was made the commissioners started a small nursery of plants and trees on the cape, and these have grown large enough now to supply most of their needs. The beach grass, plants, and trees were planted almost immediately after the first sum was obtained from the State, and every fall and spring since then plantings have been made.

The commissioners started on the windward side of the beach at the northeast end of the cape. The beach is divided at this point into three huge dunes or waves, across which the sand drifts like the foam and spray of the sea. The windward side of the first dune has been almost entirely covered with beach grass and vegetation. The grass thus extends along the face of the water for nearly a mile, comprising about fifty acres of land. A good roadway has also been made on the sand, which makes driving along the beach more than passable. Across the movable and unprotected sands driving is reduced to a complex labor problem. The horses sink in the soft sand up to the fetlocks, and the broad-tired wagons with a slight load on go down several inches until they strike the strata of wet sand, which seems to underlie the whole beach at Cape Cod. This wet, moist condition of the under layers of sand is responsible for the profuse vegetation in the belt of woods, and the commissioners build much of their hope upon this peculiarity of nature in the vicinity.

Several plantings of grass have been made up to date, and while spring planting will be practiced in the future, the commissioners are convinced that fall planting gives the best results. The grass that was planted a year ago last fall is found to be in a more flourishing condition than the grass put in the preceding or succeeding spring. Very little of it has died in either case; but in spots the wind has succeeded in burying bunches of the grass with the sand so that they have been smothered.

Along the edges of the water a wind break of young trees was planted to test their ability to withstand the cold, stormy winds and weather of the ocean. These trees were mostly pines and silver poplars. They were taken from the belt of woods back of the beach, or from Provincetown, so that they were thoroughly acclimated before transplanting. The pines have become well established in the soil, and the poplars are holding their own. It was not expected that the trees would grow vigorously in the sandy soil until the whole surface was matted over with the fibrous roots of the grasses, and consequently the present condition of the trees is an agreeable surprise to all.

Behind the wind break of trees broom and tamarix plants were put in to test their hardiness, and though they have a little, stunted growth, they are growing and spreading. A few white birches planted in the sand seemed to be unable to stand the heavy gales, and they show signs of injury and decay. None of these will probably be planted again. Willows were also tried back of the wind break, and another planting of them will probably be made the coming fall. They were whipped about by the wind, so that many of the old shoots were killed; but new branches have started up and are growing vigorously. The commissioners are pushing their work actively, but, in view of the necessity of experimenting as they proceed, the project cannot be accomplished in a day.

If the enterprise proves successful—and nobody doubts in the least that it will—some 3,000 acres of worthless sand will be converted into excellent building sites. The popularity of Cape Cod for a summer resort is growing and extending every year, and it has been nothing but the sand storms and instability of the land that has kept this region from being built up with summer cottages and settlements. If the commissioners succeed in establishing fine woods all along the coast, the value of the land for building purposes will be doubly enhanced.

Possibilities of Liquid Air in Electrical Work.*

BY ELIHU THOMSON.

The well-known effect of cooling by liquid air or like gases a conducting metal like copper is to almost abolish its resistance. Consequently a conductor so cooled is able to carry very much larger currents with less loss than at ordinary temperatures. This fact has attracted the notice of electricians and physicists for a long time past.

It has recently been found that liquid air is one of the most perfect insulators, and that most insulating materials cooled to the temperature of liquid air are greatly improved in insulating qualities. It is known also that cooling renders it more difficult to cause a spark to occur between oppositely electrified conductors, the striking distance for a given pressure being diminished.

The stability or permanence of liquid air in bulk, even when it is fully open to the ordinary atmosphere or kept at atmospheric pressure, is, of course, simply dependent upon the heat insulation provided, and if this could be made perfect, the air would never evaporate.

Recent methods, such as those of Hampson and Linde, make it possible to obtain large quantities of liquid air by simple means and with moderate expenditure of power.

Niagara power is twenty-four hour power, and as there are but few industries demanding power for the whole day, it must follow that surplus power is either not used or wasted, and that to keep the plant working night and day at full capacity is desirable, even if some of the power only yields a moderate return. Can it not be used in making liquid air? Cannot the excess at certain times of day be put to use in compressing air to be afterward liquefied on the large scale?

It would seem that large tanks of liquid air can be heat-insulated very perfectly by layers of air and fibrous material properly placed outside. The evaporated air from the tank could traverse the jacketings in successive order from within outward, so as to help keep down the temperature of the jacketings. A furnace with an internal temperature of 2,000° to 3,000° above the normal temperature of the air is easily insulated by moderate thicknesses of asbestos or other fibrous coating, so that the outside temperature is but slightly above the normal. The temperature difference between liquid air and normal air is, say, one-eighth of that between the interior of the furnace assumed and the normal, so that it ought to be possible to insulate so that but little heat would enter. In most electric long distance transmission lines a loss on the line of about 10 to 15 per cent is suffered. With 18,000 horse power this would mean from 1,000 to 1,500 horse power lost in resistance of line. If the conductors were immersed in a pipe with liquid air, the loss might fall to not over 1 to 3 per cent, perhaps, leaving available a large power for condensing air to supply evaporation. Just how far 1,000 horse power would go in keeping the conductors supplied with liquid air coatings is a matter requiring data to determine. But if it were not sufficient for the purpose, there is a surplus of power during certain hours to supplement it.

But it may be possible that a much higher voltage than is now used (10,000 to 20,000 volts) may be successfully used with conductors cooled and insulated by liquid air. If the potential could be raised to 50,000 volts, either the loss on the conductors for a given power transmitted would fall off as the inverse square of the voltage, or the conductors could be made smaller in the same proportion, or the distance of transmission increased with the same section of conductors as the square of the potential. These are matters worthy of experimental determination.

The limit to the capacity of an electric transformer to transfer energy from its primary to its secondary circuit is found in the heating and loss involved in the copper conductors comprising these circuits, and upon the nearness with which the two circuits may be placed one to the other, which is in turn governed by the insulating material used to separate them.

Could the conductors be kept cool by liquid air, and thereby their conductivity and insulation greatly increased, the work of transfer in a transformer could be much greater for a given size than it now is, or the loss could be even less than it now is, although but 3 per cent is sacrificed in ordinary practice.

Transformers in liquid air might be made entirely of copper without iron, and their light load efficiency become nearly equal to full load efficiency.

A transformer without iron would avoid the loss in the iron and would permit such a saving in material that changes in design or disposition of the copper could be made to suit the conditions.

We need not touch upon the possibilities of liquid air as a means of energy storage, for they are self-evident enough, since liquid air is virtually compressed air which remains compressed, as it were, even when exposed to atmospheric pressure; that is, addition of heat gives to it pressure and the ability to do work in suitable engines in the usual compressed air motors. Our object has been to briefly point out what may be termed possibilities in electric engineering, assuming that data favorable to the ideas presented be the outcome of experiment.

It is too early to make any predictions or calculations concerning this object. It must be confessed that it has a certain fascination. Perfection of heat insulation seems to be the key to the situation. All else seems to depend on that, the main questions being what will it cost in power and machinery to supply the necessary evaporation waste in a system of the kind outlined, and whether the voltage of transmission can be raised in consequence of the new conditions.

*Modern Machinery, July, 1897.

Electric Power at Richmond, Va.

A project for utilizing the immense water power at Richmond, Va., for the production of electricity is now assuming definite shape. It is believed that when the enterprise is established it will do more for the material development of Richmond than all the other enterprises attempted. There is more than 10,000 undeveloped horse power in the James River at this point, which if converted into electric power would be of great benefit, not only to present manufacturers, but would also tend to bring other manufacturers to the city.

Electric Celebration in Maine.

The celebration of the invention of the electric motor car was held on July 26, at Eliott, Me., in connection with the summer meeting of the American Institute of Electrical Engineers. The celebration was in honor of Prof. Moses G. Farmer, who on July 26, 1847, exhibited in Dover, N. H., what was considered the first electric car. The exercises included an interesting exhibit of early apparatus, and addresses by Professors Dolbear, Barker, Duncan, Pupin, etc.

Patent Office Employes Cannot Take Patents.

A very important decision was given on the 9th inst. by the Commissioner of Patents, Hon. Benjamin Butterworth, in regard to the impropriety of a Patent Office examiner or other official applying for patents in their own behalf, the application perhaps being assigned to them for consideration, and it is worthy of the attention of the inventive public. The Commissioner says, as reported in the Washington Star:

"The applicant, John H. McElroy, while an assistant examiner in this office, examining in the class of voting machines, filed this application complete in all its parts on February 15, 1895; on June 2, 1896, he resigned his position, and on the day following paid the government fee of $15 to secure the examination of his application, which application presents an invention claimed to be an improvement on a voting machine for which other joint applicants had filed an application, which was before Mr. McElroy for examination and action while he had charge of that class in this office. This earlier application is still pending.

"Acting under instructions, the examiner states that on August 5, 1896, and on December 23, 1896, he rejected the claims on reference to the pending applications, and also in view of the provisions of section 480 of the Revised Statutes, which is as follows:

"'All officers and employes of the Patent Office shall be incapable, during the period for which they hold their appointments, to acquire or take, directly or indirectly, except by inheritance or bequest, any right or interest in any patent issued by the office.'

"A case on all fours with this was before me on February 5, 1884 (26 O. G., 337), in which I held that in view of the statute above quoted it was not competent for an employe of the office to file an application for a patent while he was employed in the Patent Office. The reason for not permitting this to be done has special force in case of an examiner who seeks to file an application covering an improvement on an invention disclosed in some pending application of which he, as such examiner, has charge or may have charge, and the objection derives additional force from the fact that his application, if filed, would or might be referred to the division in which he is employed as an examiner. In the case mentioned I directed that the application then under consideration be stricken from the files and returned to the applicant, and that the fee be returned to him.

"Notwithstanding this decision, it seems that it is not wholly exceptional in the office for examiners to file applications which are properly referable for examination to the division in which they are employed. But whether an application so filed is properly referable to the division where the applicant is employed as an examiner makes no difference in the conclusion I reach. Whether the former decision was right depends upon the proper construction of section 480 of the Revised Statutes, hereinbefore quoted. The question is, whether the spirit and intent of the statute is intended to reach and embrace only an interest in a patent that has actually been issued.

"I do not so construe the statute. To so construe it would be to defeat in a large measure, if not wholly, the obvious purpose and intention of Congress, which was, and is, to prevent persons employed in the Patent Office from improperly utilizing their knowledge of the inventions of others, acquired as a result of their official connection with the Patent Office, and from utilizing the opportunities they have, as a result of their employment, to become rivals or competitors of inventors whose applications they have before them for examination, or in any wise to take undue advantage of the knowledge they have acquired of pending applications in their capacity of examiners or officials.

"The reason of the statute which prohibits an officer or employe of the Patent Office from acquiring, either directly or indirectly, any interest in a patent issued would seem, by fair intendment, to prohibit him from filing an application for the interest he is not permitted to acquire. The application is the evidence of an inchoate right to a patent—and the ownership becomes complete when the patent is issued. Any other construction would obviously permit, if, in fact, it did not encourage the very mischief the statute was clearly intended to prevent, as examiners might make some slight improvement or modification in inventions covered by applications pending before them for examination and file an application, change or modify it from time to time, negotiate the sale of the whole or a part interest in the invention or application, or the patent to be predicated thereon, and resign and prosecute the case and take out a patent whenever such course seemed to offer greater pecuniary advantages than to remain in the office; and thus the office might become freighted with applications filed by examiners or other employes, in contravention of the spirit if not of the strict letter of the statute, and thus become a prolific source of scandal.

"In my judgment, the construction I give to the statute is necessary in order to give force and effect to the obvious intent and purpose of the law, and to avoid scandals which would be injurious, not ruinous, to the integrity of the office. Nor does this construction do violence to the letter while enforcing the spirit of the statute. I adhere to the former ruling and direct that the application under consideration be stricken from the files and the fee returned to the applicant. He may, of course, file his application now that he has severed his connection with the office, but it was originally filed in violation of the statute, and cannot be recognized in pursuance of such filing as a pending application."

Pan-American Exposition, 1899.

There is every promise that the Pan-American Exposition which it is proposed to hold in 1899 will prove worthy of record as being one of the greatest of such events the country has ever seen, says the Iron Age. The company under whose direction the exposition will be conducted has but recently been incorporated, and among the members are Chauncey M. Depew, ex-Governor of New York Roswell P. Flower, ex-Lieutenant-Governor of New York William F. Sheehan, E. B. Thomas, President of the Erie Railroad; Edgar Van Etten, general superintendent of the New York Central; H. Walter Webb, vice-president of the New York Central; Daniel O'Day, vice-president and general manager of the United Pipe Lines Company; John M. Brinker, president of the Niagara Falls and Lewiston Railway; F. C. M. Lautz, vice-president of the same road and president of the Ellicott Square Bank, of Buffalo; J. T. Jones, president of the Niagara Falls and Suspension Bridge Railway; W. Caryl Ely, president of the Buffalo and Niagara Falls Railroad; Charles R. Huntley, general manager of the Buffalo General Electric Company; Charles R. Haskins, of Milwaukee, Wis.; Henry J. Pierce, of the Manhattan Spirit Company; Howard H. Baker, postmaster of Buffalo; Hobart Weed, F. S. McGraw, R. C. Hill, Herbert P. Bissell, of Buffalo. The company are officered as follows: President, John M. Brinker; first vice-president, Roswell P. Flower; second vice-president, Chauncey M. Depew; third vice-president, E. B. Thomas; treasurer, F. C. M. Lautz; secretary, R. C. Hill.

Cayuga Island has been selected as the site for the exposition. This island is situated in the upper Niagara River, a few miles above Niagara Falls. In size the island has about 175 acres, which is ample room for all purposes; but, should more land be desired, it can easily be obtained on the mainland. The railroads recognize in Cayuga Island an ideal spot for a great gathering of exhibits and people, and the transportation facilities promise to excel anything ever before enjoyed by Americans on such occasions. Within 200 feet of the island run the tracks of the New York Central and Erie roads, which are used by the New York Central, the West Shore, Michigan Central, Grand Trunk, Erie, Lehigh Valley, R., W. & O., Canadian Pacific, Lake Shore and Wabash roads. Between the steam railroad tracks and the island the tracks of the Buffalo & Niagara Falls electric road are laid, which assures trolley car connections without any trouble. On the outside shore of the island there is ample water to allow of boats coming down the lake and river to land, thus assuring the possibility of running excursions by water as well as by rail, and establishing all kinds of transportation facilities. A good portion of the land is covered by woods, which if cleared up, as it is proposed, will make delightful spots for excursionists to rest while at the exposition. The Little Niagara River and Cayuga Creek will afford fine runs for electric launches. On the mainland, immediately opposite Cayuga Island, is the village of La Salle, which is a suburb of the city of Niagara Falls. This village takes its name from the famous French explorer who, on December 6, 1678, landed at the mouth of the Niagara River and proceeded through the forest to the mouth of the small stream now known as Cayuga Creek, where he is said by some historians to have built the Griffon, the first vessel, other than Indian canoes, to sail the waters of the Great Lakes. Thus the locality is rich in historical interest.

The reports of the Commissioners of the State Reservation at Niagara are authority for the statement that 500,000 people annually visit the State reserve to see the falls. It is reasonable to suppose that many of this number would go to the exposition, while it is still more reasonable that the number of visitors would be largely increased by the holding of the exposition, and therefore it is estimated that during 1899 Niagara Falls will see the greatest influx of visitors it has ever known in a single year.

While the exposition will not be entirely devoted to electricity and electrical subjects, it is already announced by the management that the electrical features will predominate. The electrical power supply will be transmitted from the great power house of the Niagara Falls Power Company, a few miles below and almost in sight of the island, and its influence and presence will be demonstrated in almost every part of the exposition grounds. There will be no boilers and ugly smoke stacks to mar the beauty of the spot, but all machinery will be operated by the subtile current from the falls. Electric cooking will be the order and all restaurants will be fitted with electrical apparatus necessary to the conduct of their business. The object of the exposition is to make fitting display of the progress made in the Pan-American countries during the century that will close with 1899.

Do People Have a True Conception of Their Looks?

It has been said by one who ought to know that no man has any clear conception of how he himself looks. The expression of the face is continually changing. No artist, no camera, can catch this changing, fleeting, evanescent expression. When you look in the glass, the very intent to find out how you look is depicted on your face. The more you strive, the more the intent is intensified, and such an expression is not natural to your face. How often do we look at a photograph and find only disappointment in it? Why is this? The camera depicts the sitter just as he is at the moment the picture is taken, but very seldom can the instrument catch and record that subtile thing called "natural expression," because few persons are natural when seated before the camera. Well, what of all this? Simply this. If you are noble, loving and true, such virtues will light up your face; if you are sordid, mean and selfish, your face proclaims it to the world. Anything in your life that is active for either good or evil will impress itself upon your personal appearance. Pride, scorn, hate and lust write themselves indelibly in the physiognomy. When such ignoble qualities rule the life and have become habitual, they are impressed on the face and finally become habitual to the countenance, and the features themselves become permanently changed to accord with such expressions. It has often been remarked that persons who have been married for a long term of years come to look something alike, nor is this surprising when we call to mind that their life and environment is one, made up of the same joys and sorrows, the same hardships and trials, and the same successes and pleasures—in short, the intellectual and spiritual atmosphere of both is to a considerable extent identical, and we know that these things affect the physiognomy often to such a degree as to mould the physical features of the face into the same shape.—Extract from an editorial in the Journal of Medicine and Science.

Advances of Modern Science.

There are some that imagine that the Victorian age has been destructive of the belief in miracles. In reality it, more than any other since the world began, has brought home to the average man the stupendous miracle of the world. They call it a materialist age, which has chained the soul of man to inert matter. But almost before the reproach is heard, science proclaims that there is no such thing as inert matter, that every atom is alive, and that our mortal bodies are vast composite conglomerations of living organisms, upon whose pitched battles in our veins depend our health or our disease. To take but one instance. Imagine all that we understand by the word microbe, and then recall the fact that the microbe was practically unknown when the Queen came to the throne. In a very special fashion, science has revealed to us a new heaven and a new earth, infinitely marvelous, testifying to an understanding so vast that the mind of man cannot by searching find it out. Behind each discovery that advances our knowledge, the infinite unknown indefinitely recedes. We weigh the stars, analyze their composition in the spectroscope; we photograph the moon and make maps of the canals in Mars. But far more stupendous are the discoveries that have been made, not in the infinitely distant abysses of space, but in the infinitesimally small molecules which are all around. Science has sent its Roentgen ray through the darkened veil, and revealed the invisible and summoned all men to enjoy it as their inheritance.—"A Retrospect of Sixty Years," by W. T. Stead, in June Review of Reviews.

The University of California.

The University of California has $4,000,000 already pledged for its support, and asks architects to compete for the plans for the new buildings, and a jury of famous architects has been secured to pass upon the plans. The jury is to meet at Antwerp as soon as the plans are completed. The competition is to be international. An advisory board has been selected to fix upon such location as will best suit the landscape. On this board are Alma Tadema, Puvis de Chavannes, Andre, Luciain, and Knaus.

A Big Cannon Casting.

At the Otis Steel Works, Cleveland, Ohio, August 4, the casting of a smooth bore gun on the methods suggested by Dr. R. J. Gatling, of Hartford, Conn., inventor of the Gatling gun, was successfully performed. The government thought so well of Dr. Gatling's method that Congress appropriated $40,000 for the test. The casting weighed 30 tons and the gun, when completed, will weigh 16 tons and will carry a 400 pound projectile.

THE BOOK CARRIERS OF THE NEW LIBRARY OF CONGRESS BUILDING.

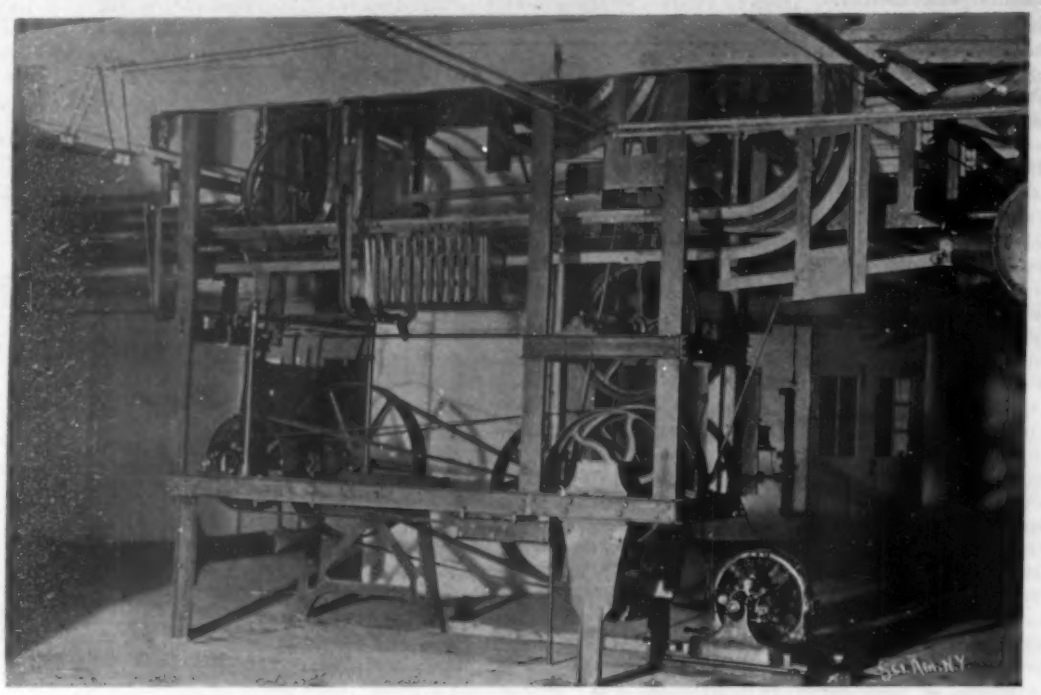
(Continued from first page.)

along. The carrier, after passing the next curve, descends to the main track and travels to the opposite terminal, where it passes through the same series of operations.

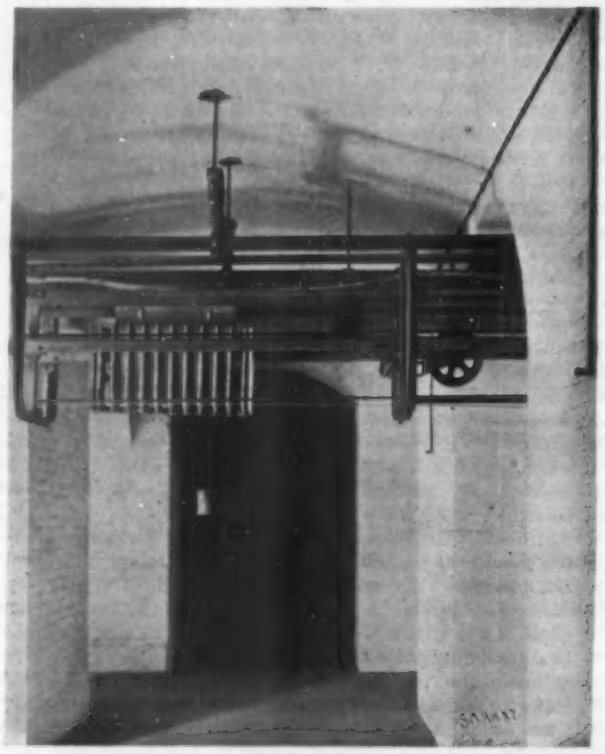
In order to keep the carrier vertical while the truck is passing the curves of the terminals, a number of sliding frames are provided at the curves; and these frames have vertical surfaces which engage the carrier and prevent its tipping. At the first curve a simple rectangular frame is mounted on slightly inclined rails, so that gravity places it in the path of the carrier; and, when the latter strikes against the frame, the frame, while bearing against the end of the carrier, travels up the inclined rails until the carrier has passed above it. At this point, two supplemental rails enter grooves in the sides of a boss on the back plate and maintain the vertical position of the carrier until the upper curve is reached. The sliding frames at this and the next two curves are the same, except that the frame for the lower curve is inverted. These frames consist of a base and two depending legs, and they slide on horizontal rails. The legs form continuations of the supplemental rails; and, as the carrier passes around the curve, the frame slides on its rail to correspond to the horizontal component of the motion of the carrier. The frame is returned to its first position by a chain which is attached to a weight in a vertical tube whose lower end is closed, and is provided with a cock to regulate the escape of the air under the weight and thus to prevent shock. At the last curve no frame is needed to steady the carrier.

The carriers necessarily move at a slow rate of speed while passing through the terminals; but, as there are twenty-seven hundred feet of cable, the speed is increased while the carriers are passing from one terminal to the other. There are two carriers on the cable and they are half the length of the cable apart, so that the carriers are in the terminals at the same time, one at the library and one at the Capitol.

While the carriers are in the terminals, the cable is run at a speed of fifty feet per minute; but while they are in the tunnel the speed of the cable is six hundred feet per minute. Two minutes are required for the passage through the terminals and two minutes in the tunnel. By the use of ball bearings, the power required is reduced to five horse power. An electric motor is used and is belted to one of two parallel shafts in a framework below the terminal in the library. Two belts connect pulleys on these shafts, and the shaft that is belted to the motor is connected by a belt to a third shaft from which the power is taken. One pulley on each of the first two shafts is connected to its shaft by a friction clutch, and the operating levers of these clutches are connected indirectly to a long sliding rod whose farther end is pivoted to a lever in the path of the incoming carrier. The rod is also connected to a lever that is in the path of the carrier as it leaves the terminal. When the friction clutch on first shaft is in, the speed of the motor is reduced but twice; and this condition obtains when the carrier has passed through the terminal; but, when the clutch on the second shaft is in, the speed is reduced four times to allow the carrier to traverse the terminal safely.



DRIVING MECHANISM OF LIBRARY-CAPITOL CARRIER AT BASE OF LIBRARY TERMINAL.



MAIN TRACK OF THE LIBRARY-CAPITOL CARRIER.

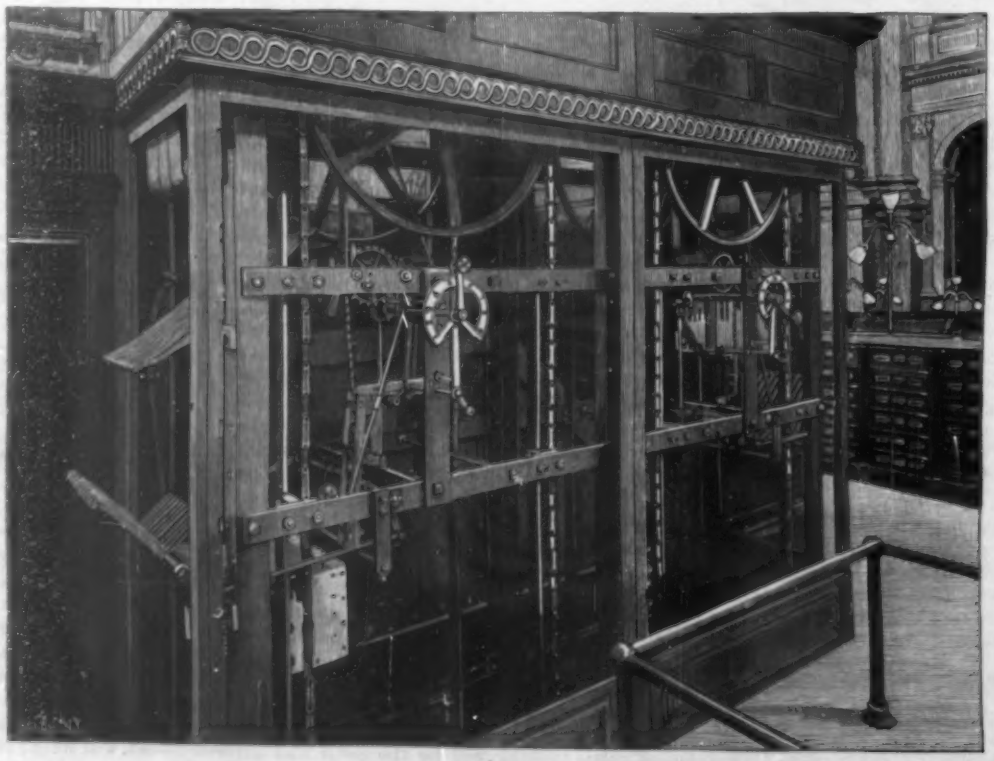
This book carrier, like that for the book stacks, is the result of much experiment during its construction, and they are the first carriers of their kinds.

The book stacks in the Library of Congress are placed in two wings, situated north and south respectively of the rotunda. There are nine floors in each stack. Two independent book carriers are provided to bring the rotunda into communication with the two stacks, and they are duplicates. They were constructed by the Miles Pneumatic Tube Company, of Boston, Mass. These carriers run from within the circular desk in the center of the rotunda, down to the second floor below, where they pass to the centers of the book stacks and up vertical shafts to the top of the book stacks.

These carrier systems employ pairs of sprocket chains four hundred and fifty feet long, each system having eighteen carriers pivoted at equal distances apart on the pairs of sprocket chains.

Each carrier has a system of keys pivoted in its back, by which it may be made to take a book to any particular floor of the book stack and there deposit it automatically. Any carrier leaving the reading room empty will pick up the first book that is placed in the delivery tray of one of the stations in its course; but it will not take up books similarly placed at any subsequent station on the line. A carrier may be made to take a book to the central station and carry one back on the same round trip; but it cannot take a book to the stack and carry one back on its return trip. The carriers travel at a uniform speed of one hundred feet per minute by sprocket wheels that engage the chains at the foot of the vertical shaft in the stacks, and the power is derived from a 2½ horse power electric motor. The sprocket chains pass over large pulleys at the top of the shaft through the book stacks, and the bearing blocks of these pulleys are adjustable vertically on screws to tighten the chains.

The carriers are in principle like those of the Library-Capitol carrier system, and they consist of a solid back and sides and a bottom and front formed by parallel, separated fingers attached to the back. In the vertical portions of the carrier's travel it is kept upright by rails which occupy grooves in the sides of the carrier, and the carrier is steadied by vertical strips as it approaches the rails, to insure the rails' entering the grooves.



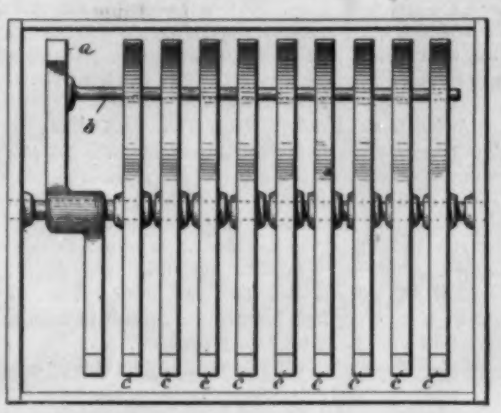
THE TERMINAL IN THE READING ROOM OF THE BOOK STACK CARRIER.

In a compartment in the back of the carrier are mounted, on a horizontal shaft, nine key levers, c, which operate the receivers of the stations, and one "pick up" lever, a, which operates the delivery trays of the stations. The key levers are duplicates and are formed with a projecting lug below and a slightly dished upper end. The lugs, when projected out, operate the mechanism that throws a receiver, consisting of a series of parallel, separated fingers, on a pivoted frame into position under the carrier to take the book from the latter as its fingers pass down between those of the receiver. A rock shaft above the receiving station is connected by links and levers to the pivoted frame of the receiver, and this shaft is turned by a sprocket chain passing over a sprocket wheel on the shaft and connected at one end to a block that slides in a fixed, vertical guide. This block has a

lug that is engaged by the lug on the proper key lever for that station when the latter lug is projected from the carrier. This engagement pulls on the chain and swings the receiver into operative position. A counterweight on the other end of the chain gradually falls in a closed tube and throws the receiver and its book out of the path of the carriers. As the sliding block descends, a weighted lever carried thereby passes a shaft and is thus forced against the key lever lug and disengages it from the lug on the block. The key levers are set for the proper station at the central station in the rotunda. The carrier comes to the central station on the part of the sprocket chains that is at the rear, and, after passing over the large wheels at the top, descends through a fixed inclined series of fingers down which the book slides to a desk. As all incoming books are left here, it is not necessary to make the receiving fingers movable. Below these fingers are a series of similar fingers that are inclined in the opposite direction, on which fingers the book to be sent to the stack is placed. The book is held from sliding down by a series of short fingers that are placed between the fixed fingers and that are mounted on a rock shaft. This rock shaft is linked to another rock shaft on which is splined a sleeve having an arm that carries a roller which sets the proper key lever by bearing against its upper end, this end being projected out in the act of releasing the receiver. These rock shafts are operated from another rock shaft above them that is turned by a lug on the pick up lever in the same manner as the key lever operates the receivers in the stacks. Thus, the roller is thrown out and sets the key lever at the same time as the book is delivered to the carrier. The position of the roller is determined by a finger which engages a groove in the sleeve and that is carried by a horizontal rack. The rack is shifted by a gear on a vertical shaft that is geared with a horizontal shaft carrying a handle over a dial with nine digits upon its face. In order not to set a key lever except when a book is to be sent to the stack, the vertical guide for the sliding block is hinged below and is allowed to tip back above, to be out of the way of the pick up. A movement of a handle throws the guide to the vertical position, where it is held by a gravity catch which is released on the upward movement of the sliding block.

The pick up is a lever having a lug at each end, the lugs being out of vertical alignment with each other. A long horizontal arm on the pick up passes behind the upper end of the key levers, so that, when any of the latter are set, the upper lug of the pick up is withdrawn, and the lower lug is projected.

The depositing in the stack is performed by a horizontally sliding tray composed of parallel, separated fingers and operated by a block sliding in a pivoted pair of guides like those used at central station for the same purpose. The carrier rises through these fingers and takes up the book, after which the counterweight carries the tray out of the path of the carriers. This



KEY MECHANISM OF BOOK STACK CARRIER.

throws in the upper pick up lug; and a fixed cam at central station, operating on the lower pick up lug, throws the upper lug again into operative position.

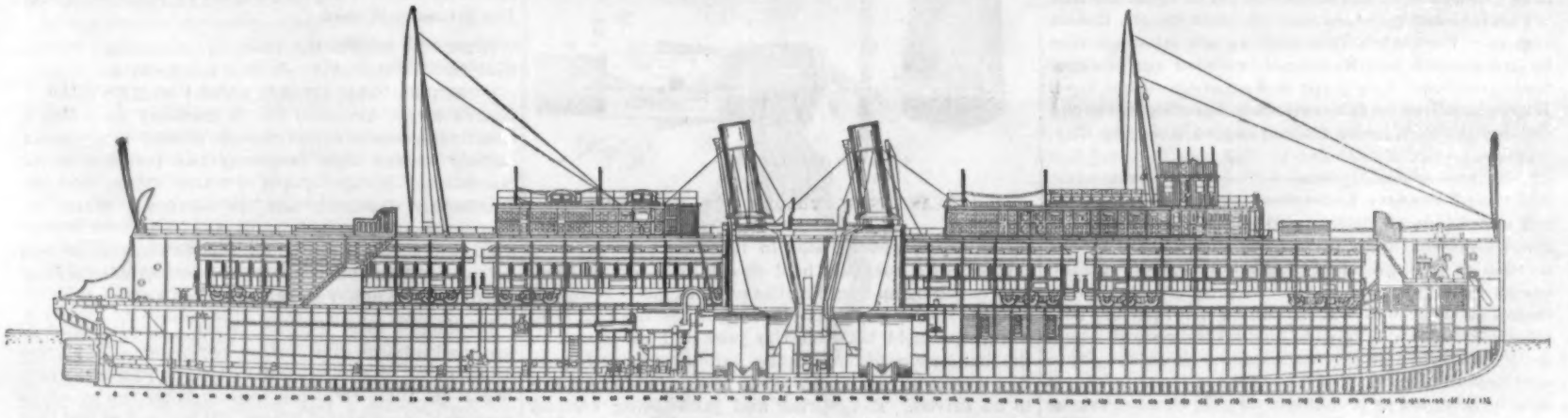
Pneumatic tubes similar to those used by cash carriers convey orders for this system and also for the system running to the Capitol.

The beautiful mahogany casing of the carrier at the reading room terminal is lined with asbestos so that no sound of the machinery may disturb the readers.

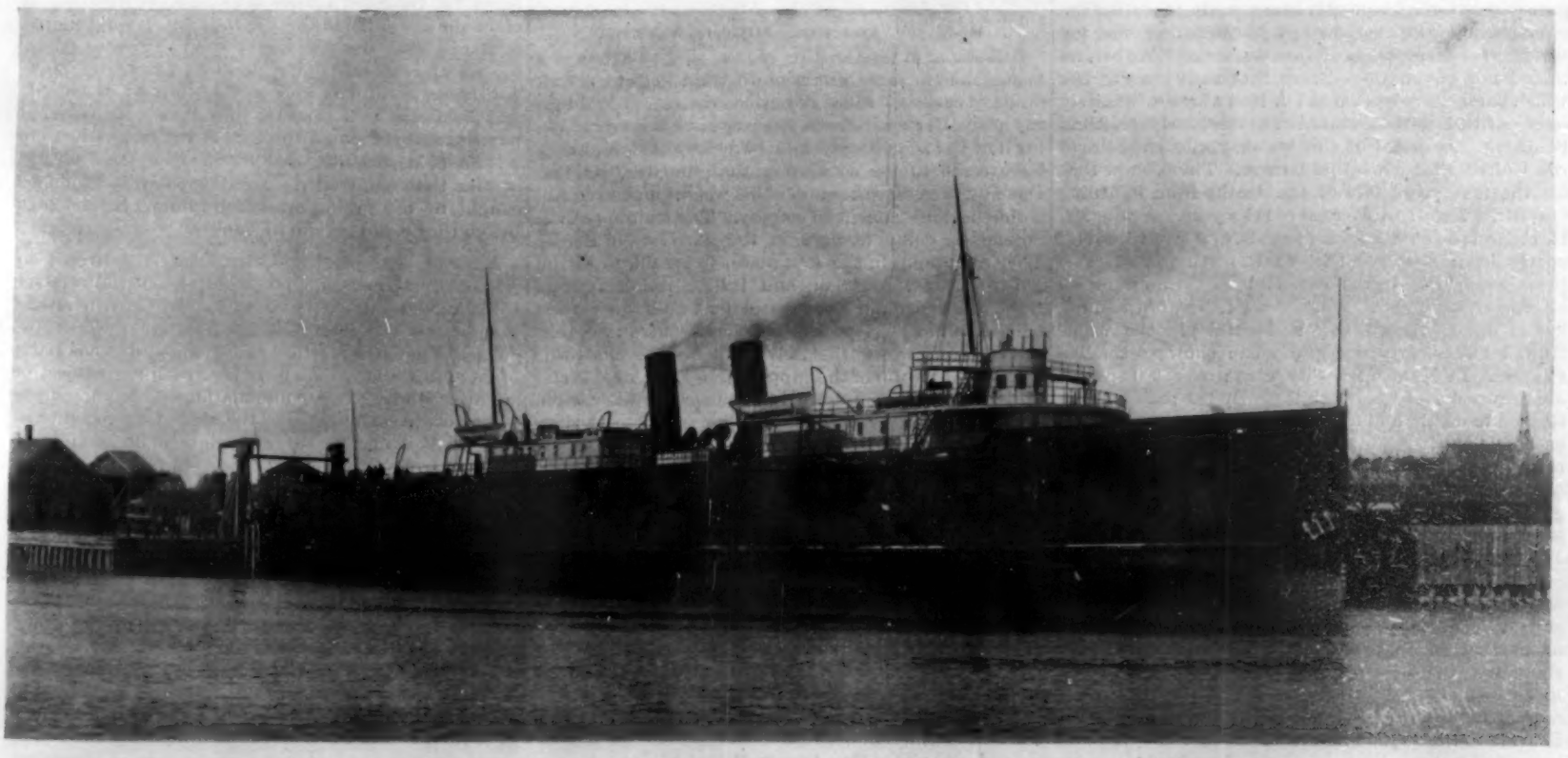
THE SEAGOING FERRY "PERE MARQUETTE."

We present illustrations of the twin screw car ferry "Pere Marquette," which has been built for the Flint and Pere Marquette Railroad for transporting freight or passenger cars across Lake Michigan. She is considerably the largest ship of her kind afloat, and in respect of her seagoing qualities she is quite unique among the large ferries of the United States. Her dimensions are 350 feet long on deck, 56 feet in beam, with a depth from keel to upper deck of 36¼ feet. She has four tracks, with accommodation for thirty freight cars or sixteen full sized passenger cars.

The Flint and Pere Marquette Railroad runs from Toledo, Detroit, Flint, Saginaw, Bay City, through Michigan and up through the lower peninsula to Ludington. From the latter place a line of steamers runs across Lake Michigan to Milwaukee, Chicago, and Manitowoc. The new ferry has been built for service between Ludington and Manitowoc, a distance of about sixty miles. As she is intended to run continuously throughout the whole year, she has been given great strength and a special shape of hull to enable her to withstand the heavy weather and the crushing strains of the ice during the winter months. Accordingly the framing from below the turn of the bilge to the upper deck is built of 12 inch channels weighing 25 pounds to the foot; the frames are spaced 24 inches center to center; the keel is 48 inches in width and weighs 32½ pounds per square foot; the center plate keelson is 42 inches wide and weighs 25 pounds per square foot, and the floor plates are 30 inches deep at the center, weighing 20 pounds to the foot, and they are connected to the center girder by double angles. On each side of the center girder, and spaced 6¾ feet from center to center, are two continuous keelsons flanged to the shell plating and extending above the top of the floor. The whole of the material worked into the bottom construction of the vessel beneath the engine and boiler spaces is made specially heavy. The shell plating from the keel to the bilge weighs 25½ pounds to the square foot. There are two water line strakes above the bilge and the main sheer strake, the last being double; all of these weigh 30 pounds to the square foot. The plating between main and upper decks weighs 10 and 12½ pounds, and upper deck sheer strake weighs 15 pounds to the square foot. From the stem to about 35 feet aft, and from the keel to about 3 feet above the water line, the shell plating is double, and it is needless to add that the interior of



LONGITUDINAL SECTION OF THE "PERE MARQUETTE."



THE "PERE MARQUETTE" THE LARGEST SEAGOING FERRY STEAMER AFLOAT.

Deck length, 350 feet; beam, 56 feet; depth, 36¼ feet; capacity, 30 loaded freight cars or 16 passenger cars; speed, 16 knots.

the vessel at the bow is strongly reinforced with heavy bracing. The propeller shafts are protected by the plating of the hull, which is brought out and around the shafting so as to form a tube or sleeve.

The motive power of the "Pere Marquette" consists of two sets of compound engines, the cylinders being 27 and 56 inches diameter by 26 inches stroke. The high pressure cylinders are fitted with piston valves and the low pressure cylinders with double ported slide valves, and the Stephenson link motion is employed. Steam is furnished by four single ended return tube boilers, 15 feet 3 inches diameter by 12 feet long. The steam pressure is 135 pounds per square inch. The cabins are all placed on the upper deck, part of them being forward of the smokestacks and the rest being located aft, as will be seen from the accompanying drawing. In the forward cabin is a passenger saloon, 36 feet long by 10 feet wide, and ten staterooms. There is a smoking room measuring 10 feet 6 inches by 8 feet wide, with lavatory adjoining. The after cabin contains a dining saloon 16 feet long by 11 feet wide, and dining room for the officers and crew.

Except in regard to her stern, which is open after the fashion of all ferry boats, the "Pere Marquette" would readily be mistaken for an oceangoing steamship. The two pole spars and the raking smokestacks give the vessel a very handsome and seaworthy appearance, and her performance since she has been upon the lakes has been fully up to expectation. With a full load in open water she has more than once been driven at a speed of sixteen miles an hour. This is over three and a half miles faster than the contract speed. During the winter she has been put to some very severe tests. On one occasion she made the trip of sixty miles with thirty loaded freight cars aboard, in the face of a heavy gale which necessitated the other boat of the company putting back to shelter; and on more than one occasion she has pushed her way continuously through solid ice fourteen inches thick and maintained the speed of ten miles an hour. This, however, is not by any means the heaviest work that she will have to do, as it is not uncommon during a hard winter for the ice to be two or even three feet thick, and the heavy gales will frequently pile it up to a thickness of eight or ten feet. In making a landing, the "Pere Marquette" is taken in stern first, and the twin screws are used in the winter time to wash away the accumulation of ice in the slip.

This interesting vessel was designed by Mr. Robert Logan, of Cleveland, Ohio, and we are informed that the company is so well pleased with her performance that they intend to build a fleet of the same kind. We are indebted for illustrations and particulars to the builders, F. W. Wheeler & Company, of West Bay City, Michigan.

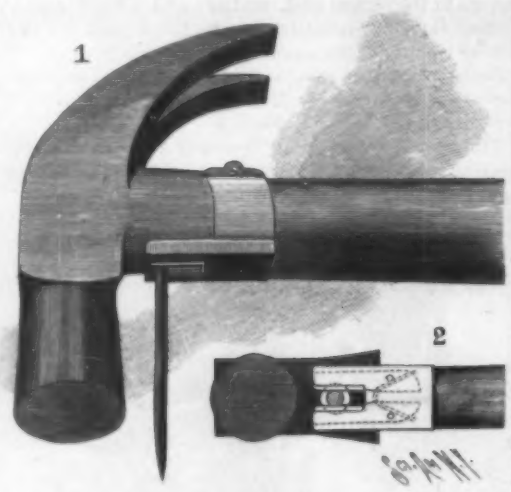
Thunder, Lightning, and Fear.

A current news item, says the Electrical Engineer, gives the results of an investigation carried out by Dr. G. Stanley Hall, president of Clark University, on the things that most excite fear in people. Of the 398 classes of objects of fear to which 1,707 persons confessed, thunder and lightning led all the rest, although in certain localities, as, for instance, those subject to cyclones, etc., the fear of the latter predominates. It may be accepted as probably true that thunder storms constitute the most pronounced source of fear with the majority of people, due, no doubt, to the always impressive and not infrequently overpowering nature of the phenomenon. But is there any justification in fact for this fear so far as fatal results are concerned? We believe there is not, but on the contrary, that many other causes which barely have a place in Dr. Hall's list are infinitely more entitled to the distinction as fear producers than lightning. As proof of this we may cite statistics of the United States weather bureau. These show that for the four years 1890-93 the deaths from lightning numbered 784, or an average of 196 a year. Again, Mr. H. F. Kretzer, of St. Louis, found from the record of nearly 200 newspapers that for the five years 1883-88 there were 1,030 deaths caused by lightning, or an average of 206 a year. We doubt whether, of the number of deaths classed as "accidental" in the whole United States, any one group can show so small a number. In New York City alone over 200 people are drowned every year, while nearly 150 are burnt or scalded to death, and close on to 500 persons meet their end by falls of one kind or another. Comparing the record of 200 lightning fatalities for the whole country with the above records for New York City with its total of nearly 1,500 accidental deaths every year, it will be seen how groundless is the popular fear of lightning. It is a survival, an inherited superstition.

But there is another point in connection with this matter which ought to be particularly comforting to city dwellers, albeit country dwellers may not be affected in like manner, and that is, that statistics show that the risk of lightning is five times greater in the country than in the city. The cause of this immunity for city dwellers is not far to seek. It is doubtless due to the predominance of metal roofs, the well grounded water pipes in houses, and probably as much as anything to the protective network of overhead electric wires of all kinds. The popular belief that stroke of lightning is invariably fatal is also not borne out by facts. Indeed, one record specially devoted to this feature shows that of 212 persons struck, only 74 were killed. Taking it all in all, there seems to be no more groundless popular fear than that of lightning. Indeed, if one can go by statistics, the risk of meeting death by a horse kick in New York is over 50 per cent greater than that of death by lightning. Yet with all the weight of statistics against its deadliness, lightning will probably continue to scare people as heretofore. Perhaps, after all, there may be a more direct cause than the mere psychological one usually ascribed to it, and that is the fact that many people of nervous temperament are affected hours before the approach of a thunder storm and thus rendered particularly powerless to stand the strain which more or less affects even the most phlegmatic natures during a disturbance in the heavens.

A NAIL HOLDING DEVICE FOR HAMMERS.

An attachment to carpenters' hammers, for placing a nail in the position where it is to be driven, is shown in the accompanying illustration, the hammer and its attachment being then disconnected from the nail and the latter driven in the usual way by the use of the hammer. The improvement has been patented by Albert R. Treat, of No. 1333 De Long Street, Los Angeles, Cal. Fig. 1 represents the application of the device and Fig. 2 is a bottom plan view. It comprises a clamp and a jaw-holding casing, preferably formed from one piece of metal, the clamp opening sufficiently to be passed over the handle, close up to the shank of the head of the hammer, where it is secured in position by a screw. Within the casing, and extending at



TREAT'S NAIL HOLDER FOR HAMMERS.

the side of and over a slot in its bottom face, are two pivoted jaws, normally held closed by a spring, these jaws engaging and holding the nail head as it is slipped into the slot, as indicated in Fig. 2, and the nail head being thus held between the jaws and the shank of the hammer head. With the nail held in such position it may be readily started in the surface where it is to be driven. The spring and jaws being entirely within the casing, there are no parts of the device liable to catch in the workman's clothes.

Dogs for Attacking Military Cyclists.

It is stated in the German papers that an attempt is being made in some garrisons to train dogs to attack military cyclists. Since the cycle was introduced into the army, German officers seem to have been considering how the advantage could be neutralized, and they have come to the conclusion that the dog, a Great Dane by preference because of his weight and strength, is the best instrument to employ. The training of the animals is going forward in the garrisons of Berlin. They are taught in the first place, it is said, to distinguish German, Austrian, and Italian uniforms from those of French and Russian soldiers, and when their education in this respect is sufficiently advanced, they are taught to throw themselves upon the cyclists who wear the uniform of the supposed enemy. The Avenir Militaire says that cruelty is employed in their training, in which the whip plays a large part. Cyclists clad in various uniforms, and so guarded by padding that they are protected against bites, ride past or among the dogs, and these instantly rush at men costumed as Frenchmen or Russians, and throw them over. If by any chance a dog should attack a representative of the triple alliance he is severely whipped, while a reward is given him when he assails the man who personates an enemy. Here, we are told, is the whole secret of the training. German officers believe that a small number of dogs would rapidly dismount a scouting party of cyclists, and they dread the employment by the enemy of dogs for this work, fearing that in this case the animals might fight among themselves, and losing their sense of distinction between friends and foes, might attack the former. The Avenir Militaire urges French officers to take up the work of training dogs for this guerre aux cyclistes.

Science Notes.

Mr. Douglas, of Harvard College Observatory, has determined the period of rotation of Ganymede, the third satellite of Jupiter. He proves it to be 7 days, 5 hours, that is, nearly equal to its period of sidereal revolution. This confirms the statement of Herschel, that the satellites of Jupiter always turn the same face to their planet as the moon does to the earth.—Revue Scientifique.

Rinderpest being a cattle disease, Dr. Koch has found out that it does not attack birds. He tried to inoculate hens, pigeons, guinea fowls, a crane, an eagle and a secretary bird with the bacillus of the disease, but it did not affect them. He was equally unsuccessful with dogs, mice, rabbits and guinea pigs, but is not sure that the disease may not be conveyed to cattle by any of these animals.

The town council of Berlin have, by the advice of Prof. Virchow, decided to appoint a municipal hydrologist, whose duty it will be to supervise the Berlin waterworks in the interest of public health. In Paris the water supply is becoming a serious question, especially in view of the coming exhibition. The consumption has been steadily increasing for some years, and the authorities are busily engaged in the consideration of schemes for securing an adequate supply in the future.

According to the Revue de l'Electricité, birds are provided for in a wonderful way by nature. It may be noticed that their plumage is always tidy, no matter how rapid their flight may have been a moment before the time of our observing them. This, says the French paper, is due to the feathers being electrified positively, the down negatively by the air, so that the attraction between them makes them cling together in their place. This is very interesting, if the statement can be substantiated.

An inhabitant of the Scilly Islands was struck by the fact that the rats there seemed to prosper greatly, although the place is very barren. He resolved to investigate the cause of this, and digging up some of the nests by the seashore, found that the rats had dragged crabs into their holes, and, in order to prevent their escape, had bitten off their legs. No doubt the prey had been seized at low tide and brought home, to be stored up there by the original device just described.—Der Stein der Weisen.

Nitrate of lead is the cheapest disinfectant known that fulfills its intent. It does not, however, prevent putrefaction. The chloride of lead is much more effective in all directions. It is made by dissolving a small teaspoonful of the nitrate of lead in a pint of boiling water; then dissolving two teaspoonfuls of common salt in eight quarts of water. When both are thoroughly dissolved, mix the solution. When the sediments have settled, you have two gallons of clear fluid, which is a saturated solution of chloride of lead in water. A pound of nitrate of lead will make several barrels of the liquid and cost fifty cents retail.

Dispatches from Tacoma, Wash., dated August 3, say mail advices give further particulars of the great eruption of Mount Mayon in the Philippines, which began on June 26. This volcano is in the southern portion of the island of Luzon. It was said at first that fifty-six persons lost their lives and many more were injured, but the latest advices at Hong-Kong from Manila place the loss of life to July 1 at fully 500. It was believed in Manila that the loss would be much greater before the volcano subsided. The flourishing towns of Malipot, Bacay and Libog were partly or wholly destroyed, and lava was still pouring into them. Many small hamlets and valleys at the foot of the mountain were certain of destruction, and it was considered no less certain that many of the rural population would be caught by the falling ashes and running red hot lava before they could get out of danger.

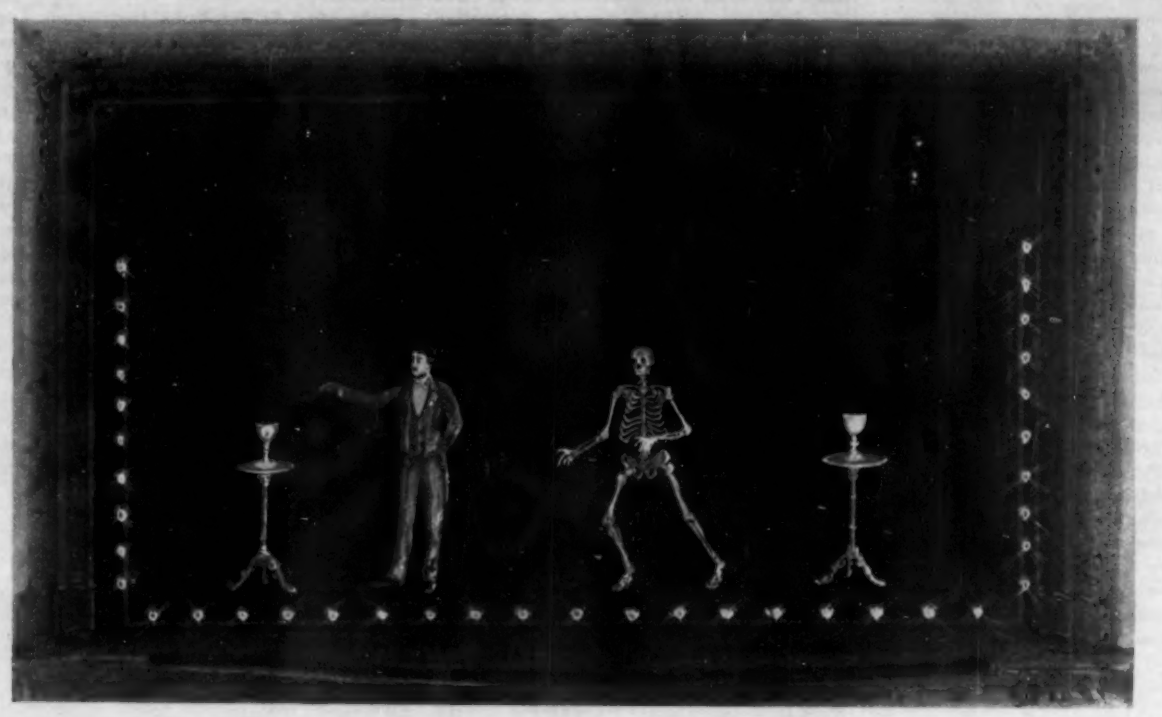
A series of geological lectures lately delivered in Boston by Mr. Grabau possessed the special value of throwing light, according to the most recent investigations, upon the feature of consolidation which peculiarly characterizes the conglomerates in some parts of New England, which have long been the subject of scientific study. This consolidation the lecturer finds to be due, in many cases, to the cementing together of sand and pebble by the carbonate of lime, silica or oxide of iron present in the water—a process even now going on, in many places, in the sediment deposited at the mouth of rivers or on the sea coasts, where the water contains an abundance of these materials. Of this formation are the sandstones, pudding stones and freestones, which occupy so important a place in modern construction, their value for this purpose varying with their resistance to the action of the atmosphere, which depends upon the nature of the cementing principle holding the mass together; some of the pudding stones are so resistant to the atmosphere that ages have not disintegrated them, due to the presence of felsite pebbles and a clay cementing substance. The great necessity, in laying these stones, of observing their lines of stratification has only within a few years been appreciated by builders.

BLACK ART.*

BY WILLIAM B. CAULK.

To the Yogi and Mahatmas of India, the magicians and illusionists of Europe and America are indebted for the ideas of many of their best tricks and illusions. While the published reports of many of the alleged marvelous effects produced by the "wonder workers" of India must be taken with a very large amount of salt, yet we must give these people due credit for being the originators of many tricks from which the modern magician has taken principles on which he has founded and created several of the grandest and most successful illusions of modern times.

Take, for instance, the illusion known as "black art," or the "midnight mysteries of the Yogi," made famous in this country by those master minds of magic, Harry Kellar and the late Alexander Herrmann. The weird illusion is founded on an idea advanced by the Yogi of India. No doubt nearly all of the readers of this article have seen "black art" presented by one of the above named magicians, yet the number who could advance a plausible explanation of how it was done are very few, because as soon as one thinks that he has discovered the secret, the performer produces an effect in direct variance with the principle on which the illusion appears to be founded.



THE STAGE SETTING FOR BLACK ART.

In this illusion the entire stage from the first groove to the rear is hung with black velvet, the floor covered with black felt, and the top is covered with black velvet, thus forming a large room lined entirely in black. The regular footlights are turned out, and a special set are used, that consist of a row of open gas jets placed on a line with the boxes, and carried up the outside of the black room, as shown in the large engraving.

The lights throughout the entire house are either turned very low or put out, with the exception of the special lights mentioned above.

The curtain rises, disclosing the black chamber. In a moment the magician appears, dressed in a white suit; a wave of his hand, and a white wand appears floating in the air, which the magician secures. A wave of the wand, and a table appears on the right, then a second table appears on the left. A large vase appears on one of the tables, and a second vase appears on the magician's outstretched hand. Both of the vases are shown and proved empty, and in one is placed a few orange seeds, and the wand is passed over the vase, which instantly becomes filled with oranges. The oranges are poured into the second, then returned to the first vase, when they disappear as quickly and as mysteriously as they appeared, and the vases are again shown empty, and again placed one on each of the tables. A borrowed watch is placed in one of the vases, from which it disappears and is found in the vase on the other table. A life-size skeleton now appears and dances around the stage, becomes dismembered, the separated parts floating about, but they finally rearticulate themselves, and the skeleton vanishes. Now a rabbit is seen in one of the vases, from which it is taken by the performer, and in his hands it becomes two, which are tossed in the air and disappear.

THE JOINTED PAPER SKELETON.

The number and style of tricks performed in the mysterious black chamber are almost unlimited, but an explanation of the ones mentioned above will suffice to show how "black art" is performed.

While the stage is draped in black, everything that appears is painted white, and the magician is dressed in white. There is an assistant on the stage all through the act, but as he is dressed in black, with gloves on his hands and hood over his head, made of black velvet, he is not seen by the spectators, whose sight is somewhat dazzled by the open gas jets. The tables are on the stage, but covered with pieces of black velvet, rendering them invisible. The second engraving shows how the assistant removes the piece of velvet and causes a table to appear at the magician's command.

The vases are also sitting on the stage, but covered with pieces of black velvet. By picking up the covered vases the assistant can cause them to appear, by removing the velvet, one on the table and the other on the performer's hand. The oranges are in a black velvet bag, from which the assistant pours them into the vase. To cause the oranges to vanish, the magician, instead of pouring them into the vase, pours them into the open mouth of a large black bag held by the assistant just over the lower vase. The transposition of the watch from one vase to the other is just as easy. The assistant merely removes it from the vase in which the performer placed it, and places it in the second vase. The manipulation of the rabbit is equally simple. The assistant places the first one in the vase by means of a black bag in which it was concealed, then places the second one in the performer's hands from a second small bag. In vanishing the rabbits the performer merely tosses them up into a large open-mouthed black bag held by the assistant.

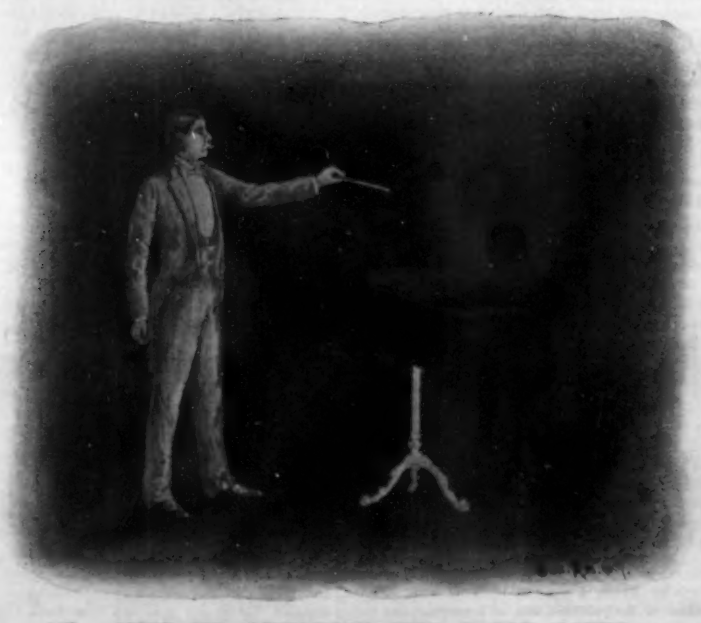
The skeleton is made of papier maché, painted white, and fastened on a thin board that is sawed to shape and covered with black velvet. One arm and one leg are jointed so as to be readily removed and replaced by the assistant when he is operating the skeleton. The two last illustrations fully explain the method of construction and manipulation of the skeleton.

The tables are made either of wood or papier maché and painted white. The vases are made of papier maché, painted white on the outside and black on the inside. The reason the inside of the vases are painted black is to prevent the hand of the assistant being seen when he places it in the vase.

This is one of the most expensive of stage illusions, costing several hundred dollars to properly stage it with the best drapery and accessories, and unless such are used the proper illusory effect is lost. In magic as well as in other business, cheap apparatus is dear at any price.

* Copyrighted 1897 by Munn & Company.—From "Magic: Stage Illusions and Scientific Diversions, including Trick Photography."—Ready September 1, 1897.—Illustrated Prospectus sent free.

A BRONZE monument of Père Marquette, the priest and explorer, was unveiled in Marquette, Mich., on July 15.



AN ASSISTANT REMOVING THE TABLE COVER.

THE DISARTICULATED SKELETON.

The Extent of the Universe.

Prof. Simon Newcomb has delivered an interesting address on the "Problems of Astronomy" at the dedication of the Flower Observatory, University of Pennsylvania. It is printed in full in Science. We take from it the following passage:

I have seldom felt a more delicious sense of repose than when crossing the ocean during the summer months I sought a place where I could lie alone on the deck, look up at the constellations, with Lyra near the zenith, and, while listening to the clank of the engine, try to calculate the hundreds of millions of years which would be required by our ship to reach the star α Lyræ, if she could continue her course in that direction without ever stopping. It is a striking example of how easily we may fail to realize our knowledge when I say that I have thought many a time how deliciously one might pass those hundred millions of years in a journey to the star α Lyræ, without its occurring to me that we are actually making that very journey at a speed compared with which the motion of the steamship is slow indeed. Through every year, every hour, every minute, of human history from the first appearance of man on the earth, from the era of the builders of the Pyramids, through the times of Cæsar and Hannibal, through the period of every event that history records, not merely our earth, but the sun and the whole solar system with it, have been speeding their way toward the star of which I speak on a journey of which we know neither the beginning nor the end. During every clock beat through which humanity has existed it has moved on this journey by an amount which we cannot specify more exactly than to say that it is probably between five and nine miles per second. We are at this moment thousands of miles nearer to α Lyræ than we were a few minutes ago when I began this discourse, and through every future moment for untold thousands of years to come the earth and all there is on it will be nearer to α Lyræ, or nearer to the place where that star now is, by hundreds of miles for every minute of time come and gone. When shall we get there? Probably in less than a million years, perhaps in half a million. We cannot tell exactly, but get there we must, if the laws of nature and the laws of motion continue as they are. To attain to the stars was the seemingly vain wish of the philosopher, but the whole human race is, in a certain sense, realizing this wish as rapidly as a speed of six or eight miles a second can bring it about.

I have called attention to this motion because it may in the not distant future afford the means of approximating to a solution of the problem already mentioned—that of the extent of the universe. Notwithstanding the success of astronomers during the present century in measuring the parallax of a number of stars, the most recent investigations show that there are very few, perhaps hardly more than a score of stars of which the parallax and therefore the distance has been determined with any approach to certainty. Many parallaxes, determined by observers about the middle of the century, have had to disappear before the powerful tests applied by measures with the heliometer; others have been greatly reduced and the distances of the stars increased in proportion. So far as measurement goes, we can only say of the distances of all the stars, except the few whose parallaxes have been determined, that they are immeasurable. The radius of the earth's orbit, a line more than 90,000,000 miles in length, not only vanishes from sight before we reach the distance of the great mass of stars, but becomes such a mere point that, when magnified by the powerful instruments of modern times, the most delicate appliances fail to make it measurable. Here the solar motion comes to our help. This motion, by which, as I have said, we are carried unceasingly through space, is made evident by a motion of most of the stars in the opposite direction, just as, passing through a country on a railway, we see the houses on the right and on the left being left behind us. It is clear enough that the apparent motion will be more rapid the nearer the object. We may, therefore, form some idea of the distance of the stars when we know the amount of the motion. It is found that in the great mass of stars of the sixth magnitude, the smallest visible to the naked eye, the motion is about three seconds per century. As a measure thus stated does not convey an accurate conception of magnitude to one not practiced in the subject, I would say that, in the heavens, to the ordinary eye, a pair of stars will appear single unless they are separated by a distance of 150 or 200 seconds. Let us then imagine ourselves looking at a star of the sixth magnitude, which is at rest while we are carried past it with the motion of six or eight miles per second which I have described. Mark its position in the heavens as we see it to-day; then let its position again be marked 5,000 years hence. A good eye will just be able to perceive that there are two stars marked instead of one. The two would be so close together that no distinct space between them could be perceived by unaided vision. It is due to the magnifying power of the telescope, enlarging such small apparent distances, that the motion has been determined in so small a period as the 150 years during which accurate observations of the stars have been made.

Lord Kelvin on Contact Electricity.

At the Royal Institution Lord Kelvin recently gave a most important lecture. He began by showing an experiment which conclusively proved Volta's theory that, when a zinc plate and a copper plate were put in contact, one became charged with positive electricity and the other with negative. Although he had shown this experiment fifty years ago at Glasgow University, says the Builder, yet an immense amount of ingenuity had been wasted recently in trying to explain away this phenomenon. He considered that Volta was absolutely right and made an appeal to physicists to study Volta's work seriously. A very interesting and novel experiment was shown. A plate of uranium was connected to one terminal of an electrometer, and was then touched by a plate of aluminum. It was seen by the deflection of the spot of light that the uranium plate became at first positively electrified; it then gradually lost its charge and became negatively electrified. Lord Kelvin could suggest no explanation of this very mysterious experiment. Another interesting topic touched upon was Becquerel's discovery of the radiation given off by uranium. This radiation is very feeble, but photographs of coins, etc., taken by its means were thrown on a screen. He stated that it had been conclusively proved that this radiation was not due to phosphorescence, or the slow radiation of light previously absorbed, and he could give no explanation of it. Lord Kelvin was slightly discursive, but he was listened to most eagerly, and his points were rapidly taken up by an appreciative audience.

Big Pension Roll.

The pension roll of the United States has almost reached the million mark. Commissioner Evans has just issued a statement showing that at the beginning of the fiscal year the pensioners numbered just 983,528, an increase of 12,850 for last year. During that year 50,101 new pensions were granted and 3,971 persons were restored to the rolls. Old age and disease, however, are working great inroads into the lists, for there were 31,960 deaths during the year. Other sources of loss were 1,074 from remarriage of widows, 1,845 orphans attained majority, 2,683 failures to claim pensions, and 3,560 losses from unrecorded causes.

RECENTLY PATENTED INVENTIONS.

Mechanical.

ROLLER MILL BELT FEED.—Evelyn E. Protheroe, Brodhead, Ky. According to this improvement the adjusting devices are at the outside of the machine, away from the rusting influence of the hot, moist air of the internal parts. The invention also provides a regulating gate to so control the stock that it will accumulate in proper quantities the full width of the belt at its delivery end, finally overcoming the resistance of the gate and dropping in an even sheet to the grinding rolls, there being no liability of the feed choking, and stock that may escape from the belt feed being automatically returned.

WELL PUMPING POWER.—George W. Grimes, Bluffton, Ind. This invention relates to devices to be placed at a central station to operate a series of surrounding pumps for oil or water wells, providing a power of large capacity for operating a great number of wells. A master shaft is supported vertically in a metal frame on a base sill, auxiliary shafts supported by the frame having gear connection with the master shaft, there being pump rod actuating devices on the master shaft and on the auxiliary shafts, and driving mechanism having connection with the master shaft. The actuating mechanism is firmly attached to the shaft to rotate with it and also to prevent a vertical movement of the actuating devices relatively to the shaft.

TOOL FOR SCREWING TREENAILS.—Albert Collet, Paris, France. A brake strap, according to this improvement, has vertical teeth adapted to engage and bite into the head of the treenail, on the inner face of its first convolution, and the strap also has horizontal openings adapted to be engaged by the ends of a lever or cross piece having at its middle an upwardly projecting square boss on which fits an operating key, a central vertical rod descending into the treenail, and centering the screwing tool on its head. The strap is locked on the nail by its teeth, when turned in one direction, thus carrying the treenail forward and screwing it in, and when turned in the opposite direction the strap opens out and turns freely without engaging the nail.

Railway Appliances.

SWITCH.—Michael F. Finnerty, Brooklyn, N. Y. A switch more especially designed for use on street railways is provided by this invention, its construction being such as to permit the motorman or gripman to readily set the switch as desired while the car is approaching it. The switch point is connected with a bar adapted to be shifted transversely, a lever is connected with the bar, and cam levers adapted to be actuated from the approaching car control the movement of the bar to shift the switch point to open or closed position. The device is simple and strong, and not liable to get out of order.

Miscellaneous.

SEWING MACHINE RIPPER.—Charles H. Stuart, Newark, N. Y. A simple and inexpensive ripping attachment is provided by this invention, readily applicable to any sewing machine, the knife of the attachment being secured to the needle bar and taking the place of the needle. A needle plate is also arranged to cover the feed device of the machine without interfering with its movements, the plate serving both as a guide for the ripping knife and a guide for the seam being operated upon. The shank of the knife is adapted to be secured in the needle receiving socket, and its blade is preferably razor-shaped, with either a straight or serrated cutting edge.

STAMP AFFIXING MACHINE.—Sinclair Tousey and Ella De Long, New York City. To facilitate putting stamps on envelopes or packages, this machine provides for moistening the place where the stamp is to be affixed, has a reservoir for the stamps, and an automatic mechanism drawing one stamp at a time from the reservoir to a plunger, one movement of the hand placing the stamp on the moistened envelope or package and operating the plunger to fix the stamp in position. Stamp-receiving receptacles may be introduced at will in the machine, providing for a supply of stamps of different denominations, to be used as desired.

AUTOMATIC DUMP FOR HOISTING BUCKETS.—Matthew Liston and Luther Wilson, Ward, Col. This improvement comprises an inclined and pivoted frame on which slides an attached cage shaped to receive the buckets and having at its upper end inwardly projecting hooks which engage the upper end of the bucket, the latter sliding the cage up the frame until the bucket overbalances the frame and its contents are discharged. Supporting slide bars are attached to the frame and extend therewith inside the cage, supporting the bucket above the cage, so the bucket will not engage the cage to slide it upward until the bucket is entirely within the cage and engages the hooks upon the upper end.

FOUR-WHEELED VEHICLE.—John W. Windle, Ormstown, Canada. According to the construction provided for by this improvement, the bottom of the vehicle body is below the top plane of the wheels, owing to the upward curve of the bolsters. The bolsters have their ends turned upward and then downward, truss bars connecting the downwardly turned portions, and the wheels having axle bearings in the downwardly turned portions. Bifurcated ends of a bolster embrace each pair of wheels.

COAT HOLDER.—Robert J. Stuart, New Hamburg, N. Y. To assist people who, from rheumatism or other cause, find it difficult to put on a coat or similar garment, this invention provides a holder having two horizontal bars with forwardly extending clamping fingers, a spring acting on an arm to clamp the fingers together to support a coat, the device being connected with a standard or support, there being also a foot lever and connections by which the clamping fingers may be operated.

LOCK.—Giuseppe Piccioni, Montefiore, Italy. According to this invention, the wards of the lock are pivoted to yield on the insertion of a tool, preventing the obtaining of a duplicate of the key by making an impression of the wards, and the key has a central socket with grooves and shoulders to act on the wards of the lock after the fashion of bits, but the socket is so formed that no impression can be taken of its shape from which to make a duplicate of the key.

BUCKLE.—Charles F. Francisco, San Diego, Cal. This invention is for an improvement on a formerly patented invention of the same inventor, the buckle frame having a tongue bar to which is hinged a keeper, the tongue having a shoulder engaged with the keeper, and the latter having an end cross bar and an intermediate fulcrum bar which serves in rocking the keeper to lift the point of the tongue.

CURTAIN FIXTURE BRACKET.—Edward W. Farnham, Chicago, Ill. This device is stamped out of sheet steel, its main plate comprising a base wing with a screw hole for the fastening screw, and a flange or bearing wing, and both wings having slots in which fit lugs on a rib plate adapted to act as a screw driver in putting up the device and remaining secured to the bracket.

STAIR CARPET FASTENER.—Harry C. Adams, New York City. According to this improvement, plates extending nearly the width of the stairs are permanently attached at the angle of the riser and tread, such plates being bent toward each other and having serrated or toothed edges, the carpet as it is stretched in place being forced into the space between the opposing toothed edges of the fastener. The fastener may be made entirely of one piece of thin sheet metal, bent to right angle, with flanged toothed edges.

DUST PAN.—Lloyd P. Ray, Seattle, Washington. This pan is made to lie close to the floor from which the dust is to be taken, and has a thin strong plate along its receiving edge. It has a removable and adjustable handle, and a spring fastening device adapted to hold the handle at an angle to the pan when the latter is in use, or permitting the handle to be carried to a position parallel with the pan, the handle also serving as a means for suspending the pan.

BLACKING BRUSH AND DAUBER.—Louis Barberie, Brooklyn, N. Y. This device is adapted for either shoe or stove blacking, the main brush having in the sides of its back, near the front end, pivot arms adapted to carry a dauber socket which may be swung up, with the dauber, over the back of the brush, or turned down in position for use, the dauber being moved and held in proper position by a finger piece. The device is very simple and can be cheaply manufactured.

Designs.

SLATE.—Belle McConnellogue, New York City. According to this improvement, a narrow box adapted to receive pencils, etc., is fitted to and extends across one end of the slate and its frame, the box having a hinged lid and a catch to hold it closed.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS, ETC.

ROMAN AND MEDIEVAL ART. By W. H. Goodyear. 1897. Meadville, Pa.: Flood & Vincent. The Chautauqua-Century Press. Pp. 307. Price $1

This is a revised and enlarged edition of a work which was published in 1893. It contains much additional information and a large number of new illustrations. Those who are acquainted with the work of Professor Goodyear will expect that the present volume will be up to his "Renaissance and Modern Art," and his "History of Art," and in this they will not be disappointed, for it would be hard to find in any language a clearer or more concise history of Roman and medieval art, and all reduced to the smallest compass. There is a continuity of thought running through the book from the first to the last page which shows that the author is a perfect master of his subject. It will be readily seen that Professor Goodyear is a believer in the "picture book," and in this he is entirely correct. Art works should always be illustrated freely by photo-engravings from the monuments, eschewing perhaps the more artistic wood cut. The 196 illustrations in the present book, though many of them are of small size, are admirably selected and are very well reproduced. We can cordially commend this book to our readers as a safe guide, which, unfortunately, many so-called art works are not.

THE PROSPECTOR'S FIELD BOOK AND GUIDE IN THE SEARCH FOR AND THE EASY DETERMINATION OF ORES AND OTHER USEFUL MINERALS. By Prof. H. S. Osborn, LL D. Illustrated by fifty-eight engravings. Third edition. Revised and enlarged. Philadelphia: Henry Carey Baird & Company. 1897. Pp. xxii, 274. Price $1.50.

This is the third revised and enlarged edition of a work which has already demonstrated its value. It treats of crystallography, surveying, the analysis of ores by the wet and dry methods, and each of the metals is taken up in turn and a great deal of information is given about each with special reference to what is usually required by the prospector. Petroleum, asphalt, gems, and precious stones are not neglected. This is probably the most practical work which can be put in the hands of the inexperienced prospector.

THE PRINCIPLES OF FRUIT GROWING. By L. H. Bailey. New York: The Macmillan Company. Pp. 508. Price $1 25.

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storage and shipment to market. It would be well if every one who has it in mind to start, or has the opportunity to care for, an orchard, or a less number of valuable trees, would first master the subject as it is set forth in this book.

THE CIVIL SERVICE GUIDE. By L. M. Bryan. New York: Dick & Fitzgerald. Pp. 112. Price $1.

A manual for applicants for government positions under the United States civil service examinations is here presented in revised form. It contains rules, specimen examination questions, requirements of applicants, salaries, etc., with full instructions for applicants for positions in all branches of the classified civil service of the United States, including the government printing department, the post office, custom house, and internal revenue service, as well as the departmental business and the non classified consular service. It cannot fail to be useful to intending applicants for positions.

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AUGUST, 1897.—(No. 142.)

TABLE OF CONTENTS.

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References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(7188) G. R. B. writes: As I intend to make the small eight light dynamo described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 600, but wish to use it as a regular shunt wound machine, could you kindly let me know what gage wire I should use on the fields and armature, and about how much? I should like to get the same voltage and amperage; perhaps greater amperage, if possible. I should like to put one length of wire on the fields, instead of in sections. A. Use No. 16 American wire gage in the armature, with 10 turns in each coil, making a total of 480 conductors in the armature. Same sized frame as original. Use No. 20 A. W. gage in the field. On each field wind 1,900 turns, making a total of 2,400 turns. This gives about one ampere more than the original design. A field regulator or outside resistance should be used containing about 10 ohms.

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

AUGUST 10, 1897,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Acid and making it, naphthylenediamin-sulfo, Rosenberg & Krecke 587,757
Acid, apparatus for producing carbonic, G. Tresenreuter 586,937
Acid, obtaining oxalic, G. F. Zacher 587,777
Adjustable wrench, W. J. Jones 587,972
Aerating and refrigerating liquids, means for, G. Mills 587,997
Alarm. See Burglar alarm. Electric alarm. Electropneumatic alarm.
Ammunition, subcaliber, F. J. Rabbeth 587,957
Animal trap, J. W. West 587,894
Armature, S. H. Short 587,871
Armature for dynamo electric machines, S. H. Short 587,705
Armature windings, wire for, S. H. Short 587,764
Atomiser, H. B. Weaver 587,890
Ax, J. B. Latimer 588,072
Axle for vehicles, antifriction, S. W. Taylor 588,062
Bag. See Bicycle tool bag. Hot water bag.
Bag holder, J. Littlejohn 588,073
Basket making machine, E. Horton 587,734
Bearing, step, T. H. Springer 588,117
Bed, folding, E. A. Ohliger 587,853
Bed, invalid, P. Jermain 587,730
Bed slat, Ryan & Weber 587,894
Beer drawing apparatus, H. Metzger 587,944
Belt coupling, J. C. Hoshor 587,903
Belt tightener, A. F. Snyder 587,877
Bicycle, H. W. Hoeft 588,103
Bicycle, T. D. & A. S. McCall 587,892
Bicycle balancer, D. J. Reardon 587,859
Bicycle brake, E. D. Rockwell 588,093
Bicycle brake, W. D. Smith 588,023
Bicycle chain adjustment, W. L. Decker 587,710
Bicycle fork crown, A. T. Matthews 587,904
Bicycle handle bar fastening, R. Dawes 587,935
Bicycle holder, J. F. Bengert 587,917
Bicycle holder, S. Elliott 587,945
Bicycle lamp support, L. J. Atwood 587,912
Bicycle lock, P. A. Chevalier 587,793
Bicycle or velocipede saddle, J. W. & G. D. Upson 588,039
Bicycle pedal, H. Fudor 588,058
Bicycle saddle support, W. L. Decker 587,711
Bicycle speed gearing, adjustable, L. T. Buckler 587,787
Bicycle support, E. W. Gram 587,811
Bicycle tool bag, D. D. Frothingham 588,059
Bicycles, power driver for, J. H. Fox 587,906
Bicycles, rear fork end for, R. G. Cornforth 587,933
Bicycles, etc., transportation chest or trunk for, C. E. Benton 588,050
Bin. See Coal bin.
Binder, cloth sample, M. Steinthal 587,881
Binder, temporary, Miller & Bauer 587,786
Boat, folding, H. E. Young 587,905
Bobbin and thread holder, T. J. Murdock 587,748
Boiler. See Water heating boiler.
Boiler cleaner, J. M. McMichael 587,909
Boilers, apparatus for supplying oil to, W. H. Park 587,854
Boring machines, combined gage and stop for, H. W. McCormick 587,938
Bottle, C. B. Wise 587,895
Bottle, C. F. Young 587,776
Bottle and stopper therefor, C. R. Gibson 587,955
Bottle stopper, J. B. Burrow 587,790
Bottle stopper, C. De Quilfeldt 588,049
Bottle stopper, O. Seig 587,759
Box. See Folding box. Musical box. Work box.
Brake. See See Bicycle brake.
Brake system, F. M. Ashley 587,690, 587,691, 587,911
Bridge, draw, W. H. Breithaupt 587,930
Broom holder, H. A. Swan 588,030
Brush, H. E. Henry 587,954
Brush, fountain, M. Arbuckle 588,047
Bunching machine, B. Poulson 588,007
Burglar alarm, C. Coleman 587,931
Burglar alarm, C. L. Knapp 587,977
Cabinet or paper case, J. T. Hoyt 588,003
Camera, kinetographic, L. Grubman 587,729
Camera, kinetographic, J. Rous 588,014
Can. See Oil can.
Cannon muzzle attachment, J. H. Hammer 587,731
Canvas stretcher, H. G. Tarnke 587,892
Capstan, E. H. Whitney 587,907
Car and brake pipe coupling, combined, J. W. Bryan 588,052
Car equalizer, T. C. Kennedy 587,834
Car fender, H. Burden 587,740
Car fender, street, J. Steele 587,880
Cars, automatic switching device for street railway, B. J. Titus 588,090
Carbids, process of and apparatus for making metallic, I. L. Roberts 588,012
Carbureter, F. H. Shaver 587,987
Carding engine, R. Grimm 587,813
Carding engine feeding mechanism, J. Hearn 587,815
Carpet fastener, C. H. Crawford 587,935
Carriage, baby, J. Paulsen 587,755
Carriage wheel, W. A. Pentecost 588,081
Carrier, W. F. Morse 587,849
Carton blank, W. H. Howe et al 587,967
Cartridge clip, temporary, T. C. Johnson 587,970
Case. See Retailing case.
Cash register, T. Carney 587,702
Chain, drive, F. A. Foster 587,950
Chair. See Reclining and folding chair.
Chair or stool, combination, J. Mitchell 587,845
Chalking device, C. A. Rittman 587,983
Chimney top, Kuhnhold & Stemp 587,978
Cigarette, W. A. Hudson 587,827
Cigarette machine, W. A. Hudson 587,825
Cigarette machine, continuous, Hudson & Hartigan 587,828
Cigarette ripping machine, E. Rankin 587,858
Cigarettes, making, W. A. Hudson 587,826
Cigarettes, process of and apparatus for making, W. A. Hudson 587,824
Circuit breaker, H. Lemp 587,838
Clamp. See Tentering machine clamp.
Clamp, F. J. Yockel 587,775
Cleaner. See Boiler cleaner.
Clip. See Paper clip.
Clothes pin, L. J. Brown 587,937
Coal bin, A. G. Hamburger 587,959
Collar fastener, P. Mullane 587,850
Commutator and lead, S. H. Short 587,868
Compass, ship's, L. Gathmann 587,954
Composition of matter and applying same, J. Q. Dixon 587,709
Condenser, vapor, S. G. Merrick 587,842
Conveyor, W. W. Willson 587,901
Copper, hardening, J. Reuter 587,861
Cord or twine cutter, H. E. Evans 587,716
Cork, L. Landau 587,835
Cork and extractor therefor, combined, J. McMurtrie 587,753
Corking apparatus, C. Von der Linden 587,981
Corkscrew, W. A. Williamson 587,900
Corn sheller, J. Q. Adams 587,906
Corset stiffener, W. G. Steward 588,028
Coupling. See Belt coupling. Car and brake pipe coupling.
Crate, shipping, S. E. McDougal 587,936
Crib, child's, F. D. Palmer 588,001
Cultivator, wheeled, H. G. Thompson 588,033
Curtain fixture, A. Southwell 588,024
Cutter. See Cord or twine cutter.
Cutter head and knife, J. B. Vuncanon 588,041
Cycle stand, T. W. Patton 587,856
Dado cutter and tenoning machine, W. J. Perkins 588,092
Depurator, K. L. Sandrowski 588,032
Display rack, J. W. Ennis 587,946
Door closing appliance, Holbrook & Goodwillie 587,823
Door, panel, J. Martin 587,983
Drill bit sharpening and dressing apparatus, D. F. Anderson 587,909
Driving wheel, chain, H. Morrison 587,848
Egg beater, W. J. Johnson 588,112
Egg tray for incubators, J. H. Young 588,044
Electric alarm, R. Penney 588,004
Electric controller, S. Harris 587,733
Electric currents, apparatus for generating constant, C. N. Black 587,921
Electric machines, field magnet for dynamo, S. H. Short 587,869
Electric meter, J. F. De Bauw 587,798
Electric motor, J. L. Thoma 587,709
Electric motors, means for controlling, S. H. Short 588,021
Electric motors, regulating, A. G. Davis 587,937
Electrical regulating device, automatic, Hoffmann & Gorges 587,822
Electrochemical treatment of fibrous material, method of and apparatus for, G. H. Pond 588,085
Electrochemical treatment of straw or other fibrous materials, process of and apparatus for, G. H. Pond 588,084
Electrodepositing device, J. Bossard 587,782
Electrodes, treating alloys for manufacturing, L. P. Hulin 587,829
Electrolysis, apparatus for, A. E. W. Boucher 587,686
Electrolysis of underground pipes and locating transmission losses, apparatus for detecting, H. P. Brown 587,688
Electrolytic apparatus, W. Thum 588,035
Electropneumatic alarm, G. W. MacKenzie 587,988
Elevator. See Water elevator.
Elevator bucket, A. W. Brash 587,697
Elevator controller lock, W. C. Fahy 588,106
Engine. See Carding engine. Gas engine. Rotary engine. Steam engine.
Engine igniter, explosive, P. Mueller 587,747
Envelope, A. M. Moylan 588,078
Envelope machine attachment, E. M. Wilcox 587,898
Envelope or paper box, carton, K. Lane 587,836
Eophones or sound receiving instruments, screen for, L. E. Thorne 588,034
Excavating and conveying machine, J. L. Potter 588,006
Exercising machine, E. Sandow 588,017
Extractor. See Lemon juice extractor.
Fastening device, B. Wolhaupter 587,773
Felt buffing or finishing machine, C. B. T. Dedicke 588,055
Fences, device for applying stay wires to wire, C. W. Holm 588,095
Fencing device, C. M. Graham 587,810
Fender. See Car fender.
Fertiliser distributer, hand, E. F. Anderson 588,045
Filaments for incandescing mantles, making, W. L. Voelker 588,040
File cutting machine, J. Turner 587,895
Filter, barrel, E. D. Sloan 587,874
Filter cleaning apparatus, I. H. Jewell 587,969
Filtering cane juice, machine for, J. A. Lombas 588,074

(Continued on page 130)

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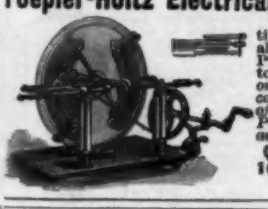

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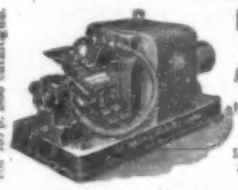

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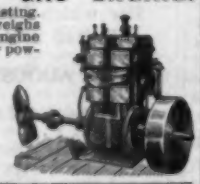

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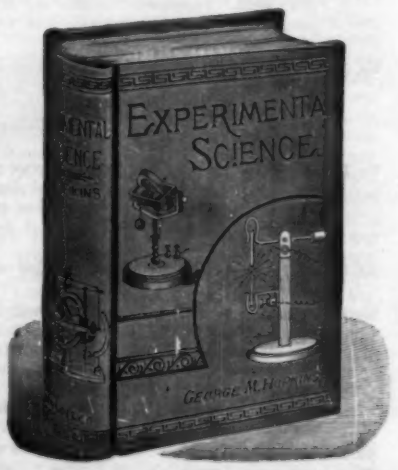

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Wheelbarrow, J. J. Snyder	588,095
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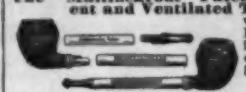

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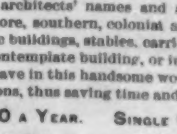

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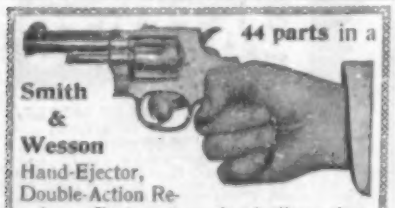

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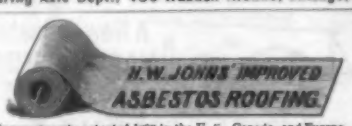

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